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Building Lathes

on a Production Basis

PRODUCT—LATHES. RANGE—14 in. to 30 in. AVERAGE MONTHLY SHIPMENTS, ALL SIZES—75. QUANTITIES IN LOTS—24 to 100. These figures tell the story of Monarch lathes, built on the "production" basis—a system rarely used in the making of machine tools—and adopted by the Monarch Machine Tool Company, of Sidney, Ohio, in spite of markets that are generally deemed extremely limited.

Two kinds of enterprise are vital to the success of a quantity-production program—sales enterprise and production enterprise. It is with the latter that this article deals. The building arrangement of the Monarch plant is not the most ideal. It was enlarged before and during the war by the addition of new buildings and was rearranged after things had calmed down, to take care of expansion by the better utilization of floor space rather than the erection of new buildings. These limiting conditions precluded strictly following a straight-line system, but an approximation was achieved. The layout is shown in Fig. 1, with the "bed-line" and the "gear-line" traced. The paths of these two components were chosen because they are the straightest and the most irregular, respectively. An important change in shop management, which accompanied the rearrangement, was the division of responsibility between two superintendents. Formerly a superintendent and an assistant superintendent supervised the entire plant. Naturally much of the work of both was a duplication of effort. By the present arrangement, one superintendent looks after the machines and machine operations, and the other gives all of his attention to assembly, detail and final.

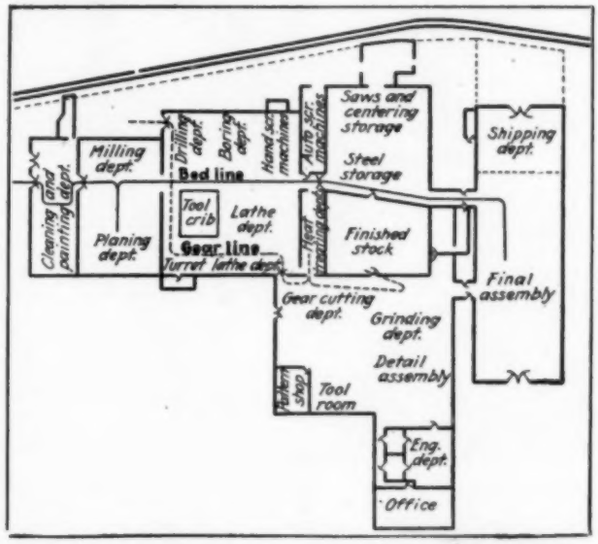


Fig. 1—Layout of shop, indicating location of machining departments, storage, tool crib, heat-treating department, painting department, assembly, finishing, and shipping. Routing of lathe beds is shown by solid line; of gears by broken lines

It was decided that the "economy of handling material is not to handle it," and to conform to that policy a monorail was installed, extending from the casting receiving platform to the assembly floor. It is gently inclined, a feature of great assistance in moving heavy parts, and one thoroughly practical, because there is no back-tracking. The last machining job on the beds is the drilling of leg bolt holes, done on a radial drill on the assembly floor. To this machine the beds are delivered via the monorail. From the machine they are carried to their positions on the assembly floor by the overhead crane. Moreover, there are 400 lift truck platforms, some of them 28 in. high, on which the headstock units are assembled. The 14- and 16-in. lathes are built in lots of 100; 18- and 20-in. in lots of 75; 22-, 24-, 26-, and 30-in. in lots of 24; 27-, 30-, 33-, and 36-in., in lots of 12. Some parts are interchangeable for two or more sizes, such parts being designed of the proper size for the largest size of the group, and consequently oversize for the others, which is an advantage to the builder and to the buyer as well. Jigs and fixtures are used wherever possible, which means on almost all parts. In spite of the feature of interchangeability, limitations as to types are not severe. For example, there are six types of 16-in. lathes. The headstocks differ, requiring six fixtures for the major operations, though the fixtures are arranged for mounting on the same machines for similar operations. The tailstock is the same for the six types. Tailstocks are interchangeable within 0.0015 inch.

The plant buys all of its castings and forgings. They are received at that end of the plant where fabrication begins, are cleaned, rough planed or milled, and stored in the open air for seasoning, the storage shed being shown in Fig. 2. After seasoning they are primed with a semi-pyroxylin coating, which dries in five or five and a half

Fig. 2—Casting storage shed, equipped with transfer cranes. A monorail also connects this shed with the shop. Lathe beds are stored under this shed for seasoning after being rough planed or milled

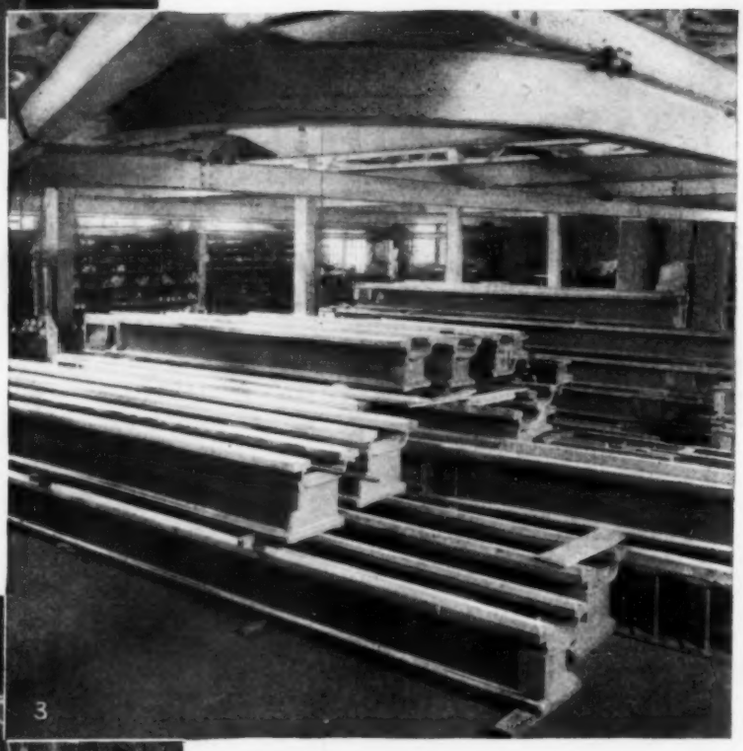


Fig. 3 — Finished lathe bed storage. After outdoor seasoning and finish machining, the beds are stored here, under a monorail, until wanted in the assembly department

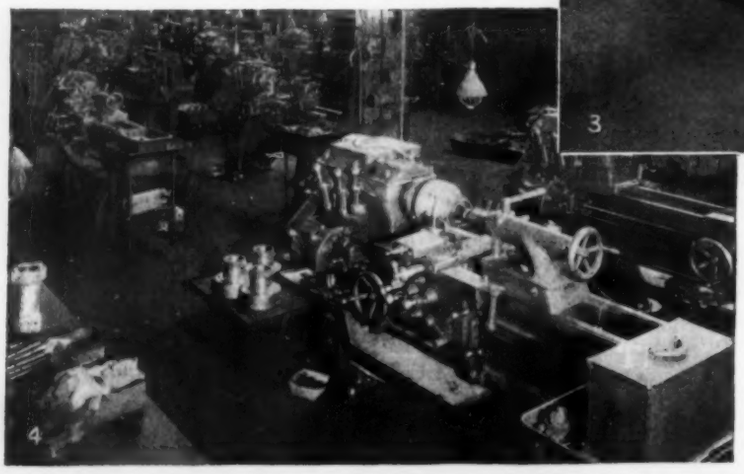
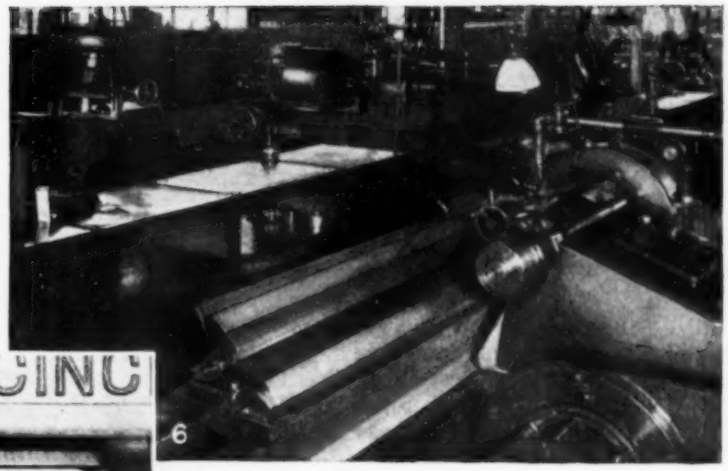


Fig. 4—A corner in the lathe department. All lathes are motor driven and helical geared heads are much in evidence. A platform truck is shown at the left

Fig. 5—Turret lathe department. Although the belt-driven lathes at the right are not old they are being replaced by motor-driven machines as at the left

Fig. 6—Where the grinding is done. This group contains cylindrical, automatic internal, and centerless grinders of the latest models. Steel shelving is used to hold machine parts and gages.



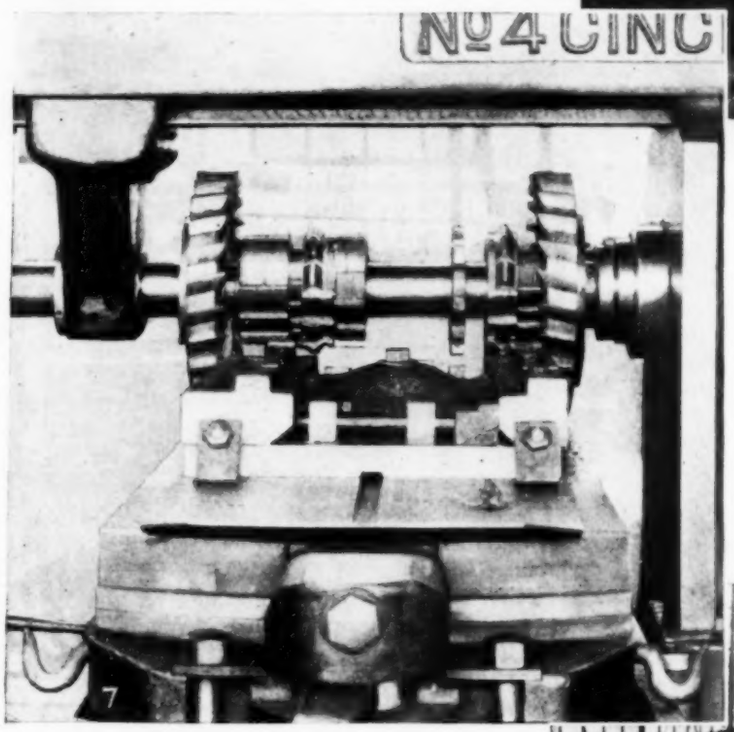


Fig. 7—Milling a lathe carriage saddle with a gang of eight cutters. Fixtures and cutters for such work are made possible by the volume of the production

Fig. 8—Assembly bay where geared headstocks are assembled and run in. The side wall is all glass and ample lamps are provided for illumination at night. Headstock platforms are shown

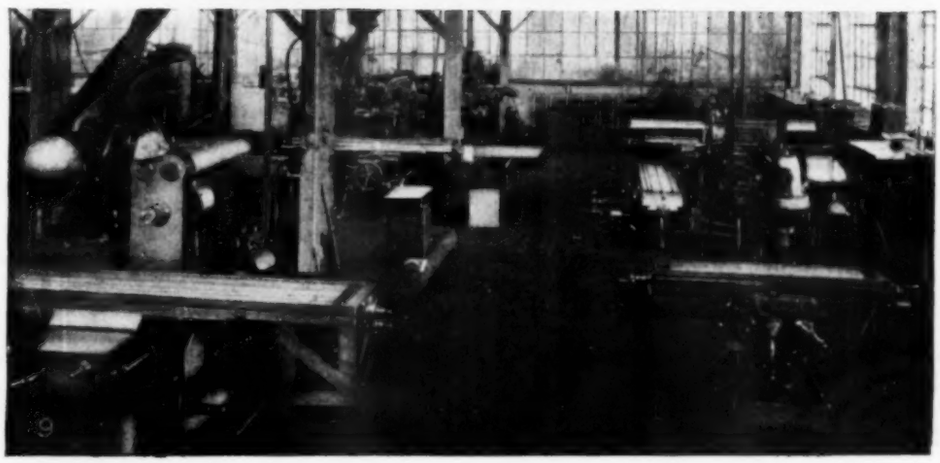


Fig. 9—A portion of the milling machine department showing the different makes of machines in use. All new machines will be motor driven

hours. They are then patched and given two coats of pyroxylin filler, after which the first lacquer coat is applied. These operations, all done before finish machining, complete the painting, except for the finish coat, which is added after assembly and test. Primer, filler, and lacquer are sprayed on.

Steel is received at one side of the building, and is stored in bins just inside, being shown in the background in Fig. 3. From the bins it is fed into manufacture, going first to the cutting-off machines adjacent. The screw machines, or lathes, receive it next. Gear cutting machines, also, are conveniently placed to receive the blanks for gears. After machining, the steel parts are sent to finished stores, passing through the heat-treating department when necessary. From the diagram of layout it will be noted that the heat-treating department is so located, with respect to the finished stores and gear-cutting machines, that practically no back-tracking is required.

Another department located to be convenient to the departments most frequently served, is the tool crib. There is never any necessity for a man to make even part of a circuit around the crib because there is a service window on each of the four sides. Three views, in as many departments, are seen in Figs. 4, 5 and 6. Part of the milling department is illustrated in Fig. 9. No attempt is made to standardize on any one make of machine, several well known builders being represented in nearly all departments.

There is, of course, in this type of manufacture, something besides layout. There are production methods of machining, arrangements for assembly, testing devices, and so on. One of the outstanding machining methods is illustrated in Fig. 7. The detail assembly and running-in of the headstock are shown in Fig. 8. Among the operations not illustrated are the testing of leadscrews, an operation performed on the Hartness comparator, the screws being checked against a master screw made by Pratt & Whitney and checked by the Bureau of Standards. A Zeiss lead testing machine is also used as a further check. Rough scraping is done by means of an Anderson pneumatic scraping machine. Finishing and crating are done in a separate room, located next to the assembly room and served by the same overhead crane.

A Number of Milling Operations

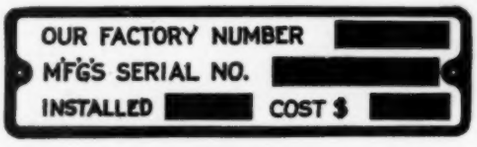
Carriages are milled on top and bottom as in Fig. 7. Aprons are milled. Bottom slides, top blocks, and swivels are rough and finish milled. So are clutches, of which there are 52 kinds and sizes in the entire line. The machine on which the clutches are machined is a Cincinnati automatic. The clutches are rapid-traversed to the cut on one side, and to the second side after the first cut has been made. Indexing is automatic.

Headstocks are bored on a Monarch lathe, equipped with a regular apron. The geared multiple-boring head, equipped with several boring bars operated through universal joints, is supported on the lathe bed and is driven from the lathe spindle. The headstock is, of course, supported in a fixture mounted on the carriage. Tailstocks and gear boxes are bored by similar arrangements. One operator, running three machines, handles both the headstock and tailstock operations.

One is impressed by the large amount of new up-to-date machine-tool equipment found in the Monarch plant. All turret lathes, all screw machines, all grinders, all radial drills and upright drilling machines, as well as all lathe equipment and most of the boring-mill equipment is new, installed either during 1927 or 1928. The average age of all machine-tool equipment in the plant is less than 3 years.

The company is constantly replacing equipment which has become obsolete through the introduction of new machines containing features which make them more productive than the former machines. This policy extends to all departments and includes the latest designs of heavy-duty planers. A comparison of production costs due to new equipment, with the cost from the old, proves that the new equipment pays for itself in full in the Monarch plant in from one to two years.

As each machine tool is installed in the plant a brass etched plate is affixed to the machine immediately showing the plant ledger number of the machine, the manufacturer's serial number, the date installed and the purchase price, including cost of installation. The plate used is shown below.



Individual Depreciation Rates for Machines

By L. L. Thwing

PLANT ledgers today usually consist of cards on which original cost, plus installation and other costs, are recorded. The value of these ledgers for purposes of depreciation and replacement depends on the man who puts the figures down on the cards. Where the size of the shop does not warrant making it a full-time job, there is a great temptation to do superficial work. Every one has his own work, and the plant ledger is just an extra task.

It is easier to sit at a desk with the card file and figure the annual write-off, but if the file is taken out into the shop and discussed in front of the individual machines the results will be more accurate. If an initial rate of 10 per cent has been adopted, it is probable that for the first five years no great divergence from the 10 per cent theory will be noticed. During the next five years, however, the annual examination should make it more and more apparent how correct the assumption of a 10-year life actually has been. The approximate cost of replacements can be found, and thus the depreciation curve can be bent to agree with recent data and known facts. By following this method the management will not be confronted suddenly with a condition not reflected in the plant ledger, as is likely to be the case if a set formula for depreciation is used.

In the past, depreciation rates have been based on the average experience of the country, and by the desire of the management to color the balance sheet. The latter we will always have with us, but the former is gradually changing to a more detailed study, first of individual plants, and now of individual machines. In some cases there are advantages in figuring the depreciation in detail on each machine and then computing the average for all machines, or for certain groups. But in any event, individual treatment is vital to accuracy in an industry employing many different types of machine tools and other costly equipment.

Handling Sheet Steel by Machine

Photographs by courtesy of the Baker-Raulang Company

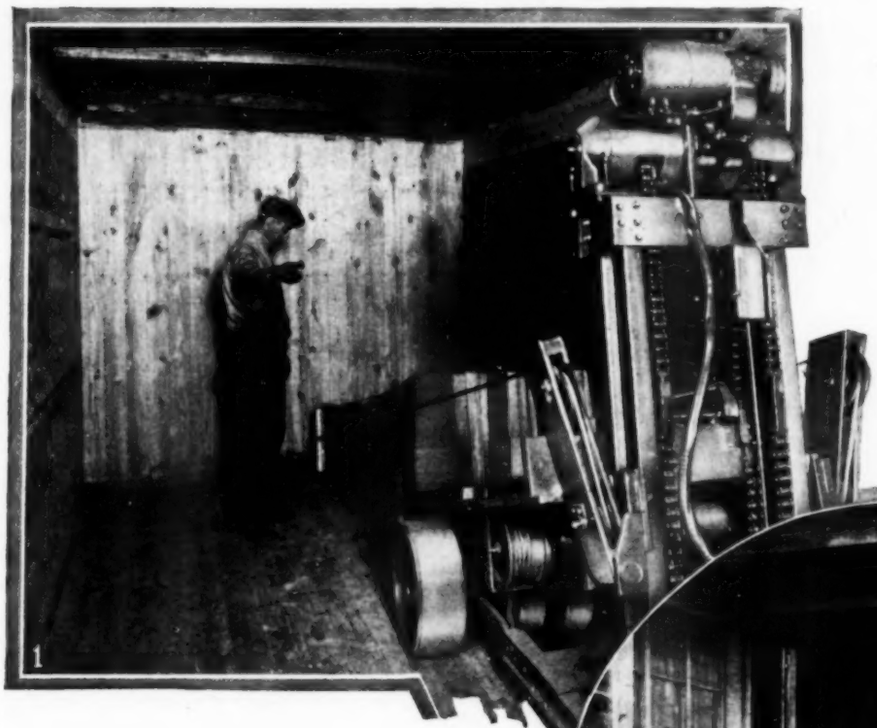


Fig. 1 — Handling large sheets by hand is a tedious, expensive, and usually unsatisfactory, process. Packages secured with steel strapping, and handled by specially designed trucks eliminate most of the difficulties. The platform of this truck is being forced under the package, after which both will be brought to the level position

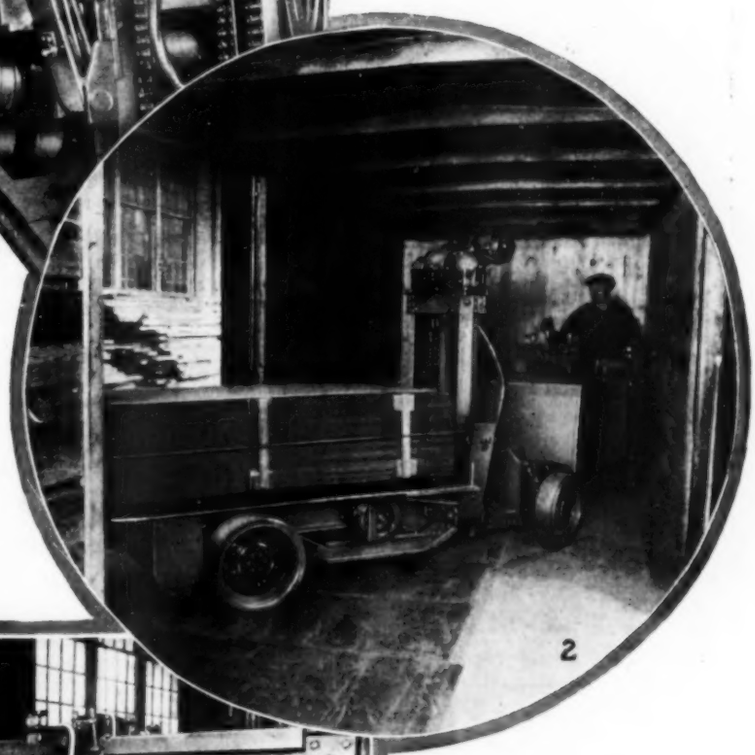


Fig. 2—Packages weighing as much as ten tons are handled by this machine. An auxiliary wheel, nearly the full width of the truck, and the use of steel plates as shown, enable this large weight to be handled without breaking through the car floor

Fig. 3—A package being lifted from the truck and deposited in its proper place in raw-materials stores, free from most of the scratching which results when sheets are slid over each other two or three times in unloading by hand

Idle Machines and Net Profit

"MY SUPERINTENDENT," began Harry Watkins of the Watkins Machine Company, "wants several new machines. Says he can lower costs, I don't know how many per cent." And he turned to our counsellor, Bill Holland, who had been asked to talk the question over with them.

"Yes, Mr. Holland, I want a new grinder for one thing, and a new planer, and some turret lathes. I can save the shop a lot of money, more than Mr. Watkins realizes, I think," spoke up Roberts the super.

"I'll admit you could save some time, Roberts, if all you say about those machines is true. But you can't keep them busy. And—" turning to Holland, "I can't stand seeing idle machinery. It ties up too much capital not to be working all the time."

"That's a hobby of his," said Roberts, turning to Bill Holland. "No matter how much saving I can show him, he isn't happy unless I can keep the machines running all the time."

"Roberts doesn't understand the value of capital, Mr. Holland. I don't need to tell you how wasteful it is to have machines that cost thousands of dollars standing idle during working hours."

"I'm afraid I can't get your point, Watkins," replied Holland. "Of course the more you can use a machine that saves you money, the more it saves. But if it saves enough to pay a dividend on the investment, you're losing money if you don't get it."

"But I want to wait until we get work enough to keep it busy, Mr. Holland. In the meantime I'm saving interest on the investment as well."

"It's net results that count," persisted Roberts. "If you could invest capital safely at 25 per cent for six months of the year, you could let it lie idle the rest of the time and still earn double what you would at 6 per cent the year around. It's the same case with machines, isn't it, Mr. Holland?"

"Looks the same to me, Roberts. And it reminds me of a shop I was in the other day. The manager showed a big grinder and told me it stood idle half the time. But he said it took the place of four old-type grinders, and was clear profit because he had sold the four old machines for about enough to buy this new one. He wasn't worrying at all because it was idle half the time."

"There's another way of looking at it, too, Mr. Holland," broke in Roberts. "He was lucky to have the grinder idle half the time because that gives a chance to increase production without putting in another machine. And reserve capacity is mighty handy in any department of the shop."

"Looks as though I was in the minority," said Watkins. "But I still have a feeling against seeing expensive machines standing idle and not earning any money."

"That's perfectly natural, Mr. Watkins," replied Holland. "But the same thing happens every night and holiday or whenever the operator is away at a ball game. We all like to get all the profit we can from our machine investments. It's a question of *net* earnings, as Roberts points out, and there's always a chance for differences of opinions as to the real net."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Selecting Shop Executives

Every candidate for an executive position, should be given beforehand a very definite statement as to what his status would be if appointed. If he will not have an absolutely free hand, he should be told so. If an executive takes a post and later finds himself on a lower status than previous, and is not allowed certain privileges he has been accustomed to, he is likely to lose his original interest and enthusiasm.

Often the candidate possesses a pleasing

personality, is a brilliant conversationalist, fluent in expression, and is forthwith engaged. But it is not long before it is found that he is a good talker but a poor performer. The efficient executive is often a man of few words, and at a first interview would not do himself justice. Therefore before a candidate is interviewed, he should be given every opportunity of expressing himself in writing and of answering a full list of questions.

—ALFRED LAYZELL.

Paying for Advice

It is a curious fact that a man will spend years to acquire the technique of the machinist profession, and then give all his knowledge and thoughts gratis. Think, for a moment, where would lawyers, doctors, and kindred professions land were they to be even half so liberal! A mechanic, if he is a good one, spends years studying, maybe not in college, but in the school of experience acquiring the expert knowledge of his profession. His profession is his equipment for earning a living and enjoying life, the same as the architect, the lawyer, and the doctor. Why, therefore, should he not charge for expert advice and counsel? I believe it is because most of us do not realize that we have something of value to sell.

Our profession is not practiced in the ornate offices that other professions possess, but down in the grime and dust of the shops. Yet we produce wealth, and create new things. We even have the majority of the other professions depending on us for their tools and stock in trade. As compared to the production of wealth, the mechanic produces more than all of the others combined. In a sense the mechanical profession is the basis of all the others; therefore, why should we not charge?

I think Tom Hudson is right, but being right does not correct the trouble. Mr. Winter's remark—"Let someone else try it first," is the attitude of too many men. If we could organize and control our stock in trade the same as do the other professions, we could soon start charging and have no fear of loss to our pocketbooks.

—I. E. HINDMAN.

Planning the Plant Layout

As a plant maintenance engineer, I have found shop foremen, as a rule, do much better than office men when it comes to planning building layouts.

Many good executives seem totally unable to visualize even simple mechanical propositions. They can form no concept of dimensions or shapes. Worse: They don't know that they don't know. Others are either unwilling or unable to spare the time to go into the multitude of details which must be considered in a successful design. Others, like the mayor who ordered that in his town the value of π should be an even 3, lay down arbitrary conditions which hamper the engineer trying to reconcile and compromise the already conflicting mechanical requirements.

There are different kind of engineers. The best are those who realize that the shop men live close to the facts, and probably know more about the practical side of their work than the engineer can ever learn. These are the engineers who can go to the shop men and get their ideas and incorporate them into the plans.

—P. H. PIKE.

Overhead and Profits

Mr. Holland's suggestion that the manufacturer add to his overhead two items, the going interest on capital invested and the depreciation of equipment, sounds good, and is no doubt correct. If the manufacturer is to make any profit it is imperative that he add every expense item to his overhead. However, this does not answer the problem in question.

With keen competition, prices are not based entirely on overhead expenses. The manufacturer must also take into consideration the prices of his competitors. If after figuring in all his expenses, he finds that the price he has to ask for his product is considerably higher than that of his competitors, considering quality, his overhead is evidently too high. Then the problem is to reduce his overhead to a figure that will allow him to meet the prices of his competitors, and still make a profit for his firm. The growing organization is usually the one that is most efficiently managed. The Eastman company would do well to follow Mr. Holland's suggestion.

—W. J. OWENS.

Finish on Machines

The appearance of the machine does count, especially if the machine is being manufactured with the intention of being placed in active competition with other machines on the market. Under these circumstances, the appearance of the machine will have a great effect upon its salability.

Another point to be taken into consideration is the effect upon the worker using machines of finished appearance. The use of such machines is a source of quality in the manufactured product. A careful worker does not receive the same stimulus to produce fine work if the machine he uses does not inspire admiration, and confidence.

A good workman takes pride in the machine he uses. A machine that merits the worker's esteem will be kept in good condition and care will be exercised in its use. A well-finished machine will last longer, and the added cost of giving it the finished appearance will be offset by the added time the machine will be available for use.

—ABRAHAM DAVIDSON.

· BOOK · REVIEWS ·

FOREMAN TRAINING. By George F. Mellen, assistant professor of industrial engineering, Penn State College. One hundred fifty pages, 4¼x7¼ in. Cloth board covers. Published by the McGraw-Hill Book Company, New York. Price $1.75.

ONE of an Engineering Extension Series prepared for this department of the Pennsylvania State College, tnis volume is of special interest in several ways. The text is divided under eight headings: General responsibilities; production and cost responsibilities; co-operation; discipline and morale; interest and satisfaction; handling men; supervision; and leadership. These subjects are well handled in a manner that is easily read and understood. Furthermore, the treatment shows a familiarity with actual shop conditions that is refreshing.

The analysis of the foreman's job and his relation to production and cost responsibility is of special interest, as is the section on discipline and morale, although it is difficult to mention a few high spots without feeling that there are many others that should be included. It is both significant and encouraging that the state colleges are evidently to become a factor in the increasingly important field of efficient foremanship. The book cannot fail to be of value to many executives.

ELEMENTARY FOUNDRY TECHNOLOGY. Edited by Lawrence A. Hartley. Four hundred twenty-three pages, 5½x8 in., cloth board covers. Indexed. Published by the McGraw-Hill Book Company, 370 Seventh Ave., New York, N. Y. Price $3.

INTENDED for school and technical college use, this book is also a valuable text for any foundryman, or for any shop man who has not had a technical training and wants to know the "whys" of the general properties and characteristics of the castings he is handling. The book contains 73 chapters, but before entering the description of foundry work itself the author has devoted 42 chapters to résumés of the factors essential to a grasp of foundry work. These preliminary chapters take up the subjects of structure of matter, chemical attractions, contraction, shrinkage, expansion weight, density, oxidation, elementary principles of mechanics, and the effects of elements on iron.

Parts 8 to 12, inclusive, contain the chapters dealing directly with the foundry, beginning with iron and its classifications, and taking up progressively the cupola, foundry sands, melting, pouring, and molding machines. The whole book is profusely illustrated, and is conveniently subdivided for ready reference or study.

HÜTTE: TASCHENBUCH FÜR BETRIEBSINGENIEURE. Edited by Akademischen Verein Hütte, E. V., and Dr.-Ing. A. Stauch. Twelve hundred fifteen pages, 4¼x7 in.; eighteen hundred sixty illustrations. Published by Wilhelm Ernst & Sohn, Wilhelmstrasse 90, Berlin W8, Germany. Price, 32 marks in cloth, and 35 marks in leather.

THE third edition makes this handbook for operating or management engineers an up-to-date reference work on German practice, on a large number of subjects. Some of the sections which have been added are: Fire protection, routing of work, non-ferrous-metal foundry work, die-casting, hot working of non-ferrous metals, press work on sheet metal, theory of cutting tools, holding devices, and spraying of lacquer.

Among those sections which have been revised are: hardening and tempering, compressed-air and electric tools, broaching, and gear cutting. About 230 pages are devoted to factory organization, and about 55 to such points as the right to work, right to make labor agreements, right to combine, and the right to strike. The first 182 pages cover details such as machine elements, tolerances and allowances and gages.

While the broad scope of the work tends to make the treatment of any one subject very brief, there is a surprising amount of information on most of the topics, and the large number of German engineers and professors who have been consulted should insure the data being representative of German practice.

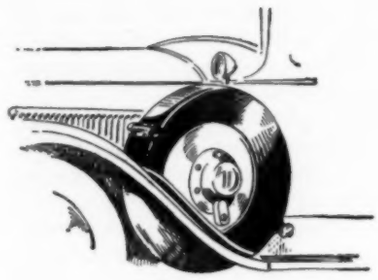
FOREMANSHIP: By E. H. Fish, industrial engineer and lecturer in foremanship for the Massachusetts Department of University Extension. Vol. 1, three hundred six pages; Vol. 2, two hundred eighty-three pages, 5x7½ in. Published by the Association Press, New York. Price, $4, for the two volumes.

IN 1921 the United Y.M.C.A. Schools brought out a course in foremanship with four textbooks and eight pamphlets, each written by a different author and on different phases of the subject. Mr. Fish has combined the subject matter from these texts with material from his own long experience as foreman, manufacturer, personnel director, and writer, in two volumes of convenient size.

L. P. Alford acted as technical editor and advisor on the two volumes, and wrote the introduction on "The New Foremanship." The foreman of today finds himself in the midst of a "new competition" in which a painting operation is suddenly changed by a new invention to a lacquering operation; in which new difficulties in machining arise because of new materials; and in which old methods of manufacturing are suddenly changed by the introduction of new cutting metals. These conditions require a "new foremanship." To deal with his new problems the foreman must have training as never before. One of the greatest possibilities of a continued high rate of progress in the near future lies in training men to use the new developments to the limit of their possibilities.

Modern foremen should know something of such things as stock keeping, production and cost systems, and the science of management, as well as how to get production and how to handle men. All these, and many more, are covered in a helpful way.

TRADE STANDARDS OF THE COMPRESSED AIR SOCIETY. Much new material has been added to this third edition which consists of forty-seven 11x8½-in. pages, together with 11 figures and numerous tables. The additional material includes a description of the A.S.M.E. standard air receivers, with a list of the standard sizes of these receivers; the pneumatic tool standards; a section on portable compressors; and additional information relating to the installation and care of compressors. The pamphlet may be obtained for 50 cents by application to the secretary of the society, C. H. Rohrbach, 90 West St., New York, N. Y.



Automotive Design

Recorded at the Show

By Herbert Chase

Many new parts and equipment items are proof of the initiative and ingenuity of the parts makers

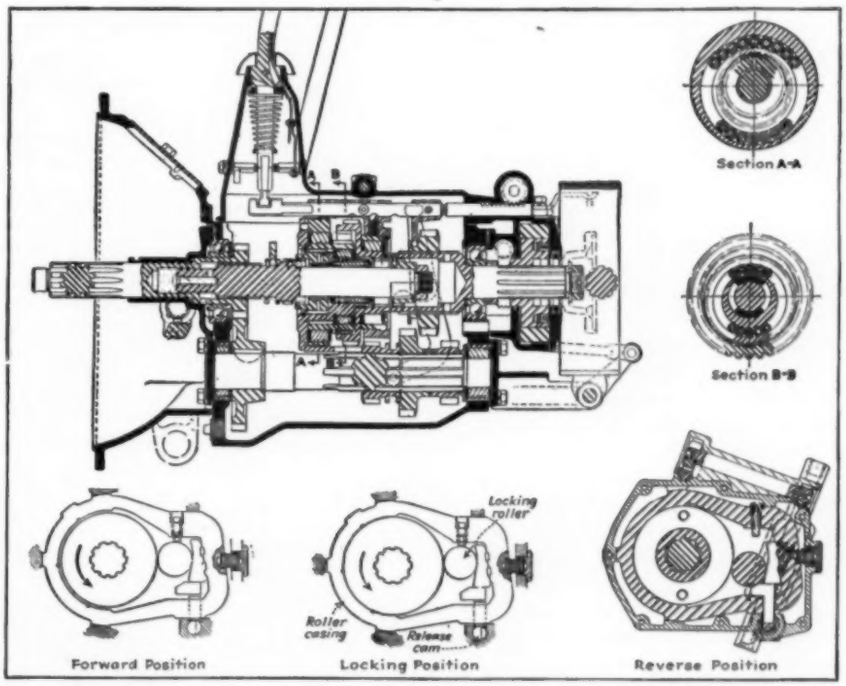
A CASUAL observer at last week's Annual Automobile Show in New York might easily have come away feeling that there seemed to be little new in the eighty odd chassis exhibited. But a detail examination and comparison of data available from past years shows that numerous changes have taken place, and that many of these have been brought about by aggressive parts makers who have profited accordingly.

More cars with eight-cylinder engines are being marketed than ever before, while the four-cylinder job for the first time is shown by only two makers. This is but one of many indications that modern automobiles are becoming more rather than less complicated. The amazing thing is that such a tendency is not accompanied by marked increases in price. Today, "sixes" with closed bodies are available for less than $600, while "eights" can be had for less than $1,300.

About 10 per cent of chassis models now have four-speed gear sets, all of them using two pairs of internal-external gears to give a quiet third speed. In these gear sets the low first speed is latched out and used only in an emergency, the shift being standard in most instances with this exception. The new Franklin chassis uses the same general arrangement, but it omits the low first entirely since what would be second and actually is low, gives a 3.625 reduction, which with a 4.54 or 4.73 axle reduction is said to be low enough for any condition met in service. All these gear sets were originated and developed by parts makers for whom they have meant new business.

Close to one-third of all chassis now have lubricating systems by means of which all or nearly all points on the chassis, such as spring shackles, brake rods, and steering connections are fed oil from a central reservoir by a manual or foot-operated pump. These systems represent a great advance in convenience to the car owner and make for a quieter and longer lived chassis. Four parts makers are sharing in this business. Some of the systems meter the oil going to each bearing. Any one of them might be adapted easily to machine tools or to other machines. Only a few years ago there were no four-wheel braking systems on American cars, and virtually every car or axle maker built his own brakes. Today four-wheel brakes are universal, and at least two-thirds of the chassis are equipped with parts makers' products, probably at a lower price than the car makers could build them in their own shops. Concentration on such lines doubtless results also in a better average product than otherwise would be available. The Bendix Brake Company now is said to be producing 50,000 brakes a day. Some of these are two-shoe and some three-shoe types with so-called "servo" or partial self-actuating features. These brakes represent interesting developments in heavy stampings that are welded together. There seems to be no reason why similar construction could not be used in brakes for elevators, hoists and other machines. Cadillac, La Salle and Pontiac are among the cars with redesigned braking systems made in the car manufacturers' own shops.

The Westinghouse Air Brake Company and the Bragg-Kliesrath Corporation both are making vacuum-type power brakes now supplied as standard equipment on Chandler and Stutz chassis, respectively. Both of these



Four-speed transmission used on the Stutz and Blackhawk. It employs two pairs of internal-external gears in third speed to obtain silence; second, low and reverse are obtained in the conventional manner. The three cross-sections at the bottom show the "Noback," a device used to prevent a car from rolling backward when on grade

brakes have been used with success on truck and bus chassis, but are relatively new on passenger cars.

Another new braking development is called the "No-back." This device is designed to prevent a car from rolling backward when stopped on a hill, and should prove very useful, especially in hilly country. It comprises a semi-cylindrical metal brake shoe brought into action by a roller and wedge arrangement, which locks automatically when the car starts to roll backward, but is instantly released upon forward motion or by throwing the gears into reverse position. This device is incorporated in the four-speed gear set furnished by the Detroit Gear and Machine Company for use on the Stutz and Black Hawk chassis. It is located between the parking brake and the gear set proper. Fabric-type universal joints are used less generally than at one time. Although quiet and requiring no lubrication, they sometimes fail to hold the shaft exactly in the correct axis, and this results in vibration. They also permit of less end play unless mounted on a sliding spline hub. Some car manufacturers still build their own universals, but the bulk of this business is divided between the parts makers, Spicer Manufacturing Corporation and Mechanics Machine Company having by far the greatest number of customers.

No very marked change in clutch design has occurred since last year, except that some driven plates formerly fitted with a fabric-rubber hub flange connection have been altered to include a pair of pressed metal members interconnected by a number of small coil springs arranged circumferentially under compression. These members are said to produce less chattering or to prevent it, while they also tend to cushion the torque impulse in starting.

About one-third of American chassis are equipped with mechanical fuel pumps instead of the vacuum tank once almost universal. A few cars use a vacuum tank with a pump to provide the vacuum instead of depending upon manifold depression. This avoids the chief disadvantage of operation by manifold vacuum, namely that the pressure difference (and pumping rate) is least when the throttle is wide open and the demand for fuel is greatest.

The fuel pump in most general use is the A.C., a diaphragm type, actuated by a cam or eccentric on the engine camshaft. The diaphragm of this pump is made up of several thicknesses of thin fabric impregnated with some flexible substance which, of course, is not soluble in gasoline. In most cases the fuel is fed through a strainer fitted with an easily-detached glass bowl which makes water or sediment easy to see and to remove. This simple device, never seen a few years ago, is a new source of revenue to the parts maker. It is equally useful on any small fuel feed line such as that on a household oil burner, for example, and the same is true of the diaphragm pump.

Most engines are fitted today with an external oil filter designed for quick removal, the filter itself usually being some kind of "wool" or fabric arranged for easy cleaning or renewal. Durant models are provided with a filter which is cleaned by opening a bottom drain and blowing air through from the top in a direction opposite to the normal oil flow. Such devices, in common with so-called rectifiers designed to remove fuel from the oil, are other examples of equipment for which the enterprising makers have created a good market where none existed only a few years ago. These oil filters also have many possible applications outside the automotive field.

A majority of cars still provide grease or oil-gun connections for lubrication of shackles and most other chassis bearings outside the engine, gear set and differential housing, but there is a definite tendency away from this practice. One alternative is the centralized chassis lubricating system already mentioned. A second is to provide, particularly in place of metal shackles, a rubber or fabric member which needs no lubrication. The third is to use grease-packed ball bearings, as is done on the shackles of the new Pierce-Arrow and Studebaker eights, roller bearings, or oilless bushings thoroughly impregnated with graphite. On at least one car all brake shafts are mounted in Timken bearings.

Engine Parts Made Outside

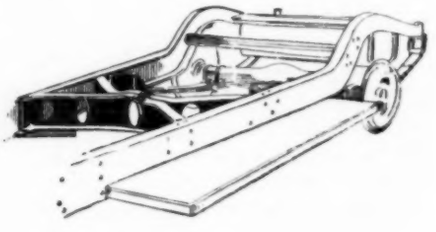
Another field in which parts makers have gotten a strong hold is that of valve and piston manufacture. Formerly, both these parts were made almost exclusively by the engine or car manufacturer but this is not true today. Valves, particularly those of special heat-resisting alloys, such as the Thompson Silchrome valves, are gaining almost a monopoly, while tools for their production have been developed to such an extent that the car or engine builder finds it just as cheap or perhaps cheaper to buy as to tool up for doing the job in his own plant.

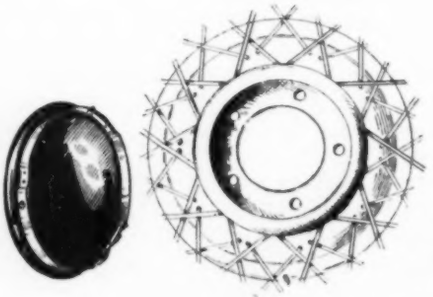
Much the same can be said of pistons. High-speed engines have necessitated light reciprocating parts. The Bohn Aluminum & Brass Corporation found an answer in the Bohnalite piston, an aluminum-magnesium alloy in which an Invar strut is provided to maintain desired clearances regardless of temperature. Such pistons should be equally suitable for air compressors where light weight and high speed are of importance.

Bohn also has made a marked success of the Bohn Ring True Bearing which now constitutes 60 per cent of its production and is used in a large proportion of motorcar engines, as well as in engines for trucks, aircraft, tractors, and motorboats. These bearings are made with either a bronze or steel shell lined with babbitt. They are suitable, of course, for a great variety of uses outside of the automotive field.

Stampings, both large and small, play a most important part in the modern car. The Edward G. Budd

Cross bracing is more substantial





A stamped cover plate for wire wheel hubs that snaps in place

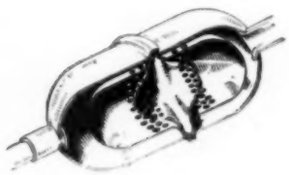
Manufacturing Company now makes virtually a whole body shell from five or six stampings. The whole side of the body including door and window openings is made sometimes from a single sheet. The cowl and rear panel, seat base and seat back, windshield frame and doors, each made in a single piece, complete the body. Naturally it is far cheaper than was thought possible a few years ago. Welding is used extensively for joining the body panels. About the only wood needed in such a body is that to which the interior trimmings are tacked.

Among the smaller stampings are those used for such parts as running boards, battery boxes, tire covers, and wheel hub plates. In some cases the running boards have the rubber covering vulcanized to them. Hupmobile is employing a sheet-metal cover for the spare wheel carried in the forward fender.

Wheels now are developed so that wood, disk and wire types all are interchangeable on the same hub. A recent development is a stamped coverplate for the hub of wire wheels so arranged that it hides all of the bolts. It is made so as to snap into place, and is removed by using a screwdriver to pry it off. This arrangement makes a neat looking job, and keeps mud from caking on the hub nuts.

It is becoming a very popular practice to carry one and sometimes two spare wheels with tires in wells in the front fenders instead of mounting them on rear carriers. A variety of locking devices are provided, many of them having built-in cylinder locks, which mean buying more equipment from the parts maker.

Today many cars are provided with coincidental locks which lock some part automatically and simultaneously, such as steering gear or gear set, when the ignition lock is turned. Underwriters now allow a considerable reduction in theft insurance for cars fitted with an approved form of such lock. Of all cars stolen it has been found that only a fraction of one per cent is known to have been locked securely prior to theft. A coincidental arrangement assures such locking, for even a careless motorist rarely leaves his car without turning and withdrawing the key in the ignition switch and no wiring around such a switch can defeat an approved coincidental lock.

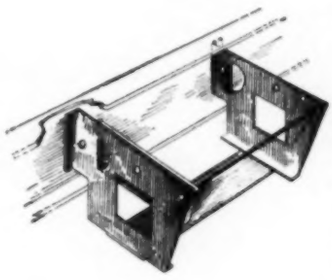


There are numerous examples of welding found in the cars at the show, in addition to that on body panels referred to above. The latest Nash chassis, for example, has the pads forming the rear engine supports welded to the tubular cross member of the frame which runs under the rear end of the power plant. Many mufflers have welded joints where rivets or through bolts formerly were used. When crankshaft counterweights are bolted in place it is common practice to weld the heads of the bolts to the counterweights in order to preclude any possibility of loosening.

Frames are almost universally deeper than before, due to the trend toward longer wheelbases once more. One maker secures additional stiffness by riveting an additional channel within the main channel of the frame for a portion of its length. Cross-bracing is more frequent and more substantial, and takes many forms, such as that of an X in one case.

Most cars in the show had external bright work chromium plated, usually over nickel. Chromium gives a whiter and more enduring finish than nickel, and holds its polish better. Chromium plating also is applied to some machined surfaces as a protection against rust and wear, for this metal is extremely hard and wear-resisting. It is used, for example, on the steering knuckle pins of the new Studebaker Commander eight. These pins are first lapped and then chromium plated, a practice which could be followed with profit on many machine parts in numerous applications.

There is less tendency to use highly ornamental radiator caps. These parts now are made less conspicuous, as a rule, in order to blend with the body lines. They often are die-cast, and nearly always are chromium plated. Practically all cars except those in the very low price class have automatic radiator shutters operated by a Sylphon or some other thermostatic member, and many engines also have thermostatic valves to control water flow and insure rapid warming to an efficient operating temperature. Distance-type thermometers with instrument board indicators, and gasoline gages with indicators similarly located, are quite common. All these devices have added another large market to the growing parts business and provide many a factory with profitable items to manufacture. Of course the same or very similar devices find many non-automotive applications also.



There is a decided tendency to fit shock absorbers on all four springs and the trend toward the hydraulic type is quite marked. Gabriel is among the makers now producing this type. The links used to connect the shock absorber arm to the chassis frame or axle sometimes are fitted with rubber blocks to cushion the shock. Many absorbers are designed to produce a damping action on both up and down motion of the spring.

Numerous other indications of progress in design details could be cited but enough have been mentioned to show that there is ample opportunity for the wide-awake parts maker to find a market in the automotive field as well as in many other fields where similar parts can be used to advantage.

Johnson Chucks the Time Clock
Discussion

By Chas. H. Willey

I DON'T quite get the idea of chucking the time clock as Johnson threatens doing in Vol. 69, p. 885, of the *American Machinist*. The time clock has stood the test of time in thousands of factories, and I fully believe that it is a real factor in lower living costs for us all. It keeps all hands up to scratch, and shows no favorites. If a man arrives an hour late, or one goes out at mid-forenoon, it is recorded, as well as the fact that he worked overtime until 5:15. However, if you are to dock an employee for 15 min. tardiness, then he must be paid for 15 min. overtime if he works overtime.

I know, from 30 years' experience in the machine shops of the east, that there are very few shops where a time clock would not be needed to help the careless man about getting to work on time. It is only in the few small shops that you find them sticking around after the whistle, giving the company the long side of it.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Shall a Man Sit Down to Work?

"SAY, Al, what do you think about a man sitting down at his work?"

"That depends on a number of things, Ed. Some work you have to sit down to do, some work you can do just as well sitting down as standing, and other kinds you can do best by standing. Why the question?"

"I was visiting a foreman in the Tucker plant the other day and he bawled a man out for sitting down at the job. It was a hand job and I couldn't see but the fellow could do it just as well sitting as standing. After we left the department the foreman explained that it was against the rules to sit down in his shop and that the man knew it. 'Out late last night, I suppose,' he said, 'but he can't loaf on the job here.' I didn't argue it with him, but, of course, I can see his idea."

"Well just what is the idea, Ed? I don't get it."

"I guess you'd call it discipline. With a rule against sitting down, and wanting to keep every man on his toes, I suppose he had to 'call' him."

"That sounds like a mighty weak alibi to me, Ed. Why have such a fool rule, anyhow? And why shouldn't a man sit down if he can do his work just as well? That isn't my idea of discipline at all. And to bawl a man out before a stranger was a fool trick."

"But do you like to see men sitting down when you go through a shop, Al?"

"I like to see men doing a good job, comfortably, Ed. If the job demands standing up, I wouldn't have them sit down to do it. But I believe the more comfortable you make the job, the better work you get, and the more the men will try to help things run as you want to have them run."

"But a man just naturally can't feel very active on manual work while sitting down. The two don't go together."

"There may be a grain of truth in what you say, Ed, but a man can't feel very active, or contented either, if a shop rule forces him to stand all the time when he knows he can sit down part of the time just as well."

Is Ed right about his idea of maintaining discipline? Is Al right as to making a workman as comfortable as possible? What about bawling a man out before a visitor?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Finding New Ideas on Shop Visits

IN THIS highly competitive age a man is not paid for what he knows, but rather for how much he makes of his knowledge. In large organizations, where direct personal contact is impossible, the executive responsible for the spending of money is entitled to know what he gets for the company's money. So I rather agree that William's idea of giving foremen a list of things to look for, and report on, is a good one.

Perhaps a detail or two about specific methods of performing certain operations will well pay the cost of such a trip. But why not also get some of the bigger facts behind the operations of the plant visited? A forman is bound to get the shop details anyway, but he may not look for the bigger things if his thoughts are not guided in that direction. The easiest way to have anyone with a new idea clarify his thoughts on it is to get him to write it up.

Ed is wrong in objecting to answering a questionnaire, because by answering, he is really selling himself and the visit idea to the major executives. Instead of the idea being continually under suspicion as to its effectiveness the major executives will encourage it for by this means they have concrete evidence of its utility.

—ALBERT HOERSCH.

Does Appearance in Tools Count?

THE Evans plant is unwise in broadcasting instructions against the appearance of tools. The time spent in improving the appearance of a tool is by no means wasted, and will be offset by the length of the life of the tool. A neat looking tool will receive much more care and attention, and will be handled in a manner that befits its appearance.

A tool is like a car, the appearance counts. Give a man a tool and he will treat it according to its appearance. If the tool is neat looking, he will realize that a lot of time was spent on it, and strive to take as good care of it as possible. But give him a shabby looking tool and he will treat it rough, naturally. —EDWARD PIRINIAN.

Letting Good Men Get Away

IF A certain man in the department is slated for a better position, the foreman ought to encourage him by letting him know, though not by taking him aside and delivering an oration. The simplest way to tell him is to let him work occasionally as assistant to the man whose place he is headed for, or do his work when he is out. It might even pay to assign the other man to a different job temporarily, in order to give the understudy a little training. Handled in this manner, the average man will be quick to see that he is being groomed for a better job, and that it is to his interest to stay with the firm and to wait for his opportunity. This way of meeting the situation has the additional advantage of making it unnecessary for the foreman to give any verbal promises which later circumstances might force him to break.

—CHARLES SPRAGUE HAZARD.

THE · NEXT · TOPIC

Helping the Tool Designer

ADVANCE QUESTION

Al says the new tool designer's habit of discussing the design of fixtures with the foremen is good. Ed disagrees. How far do you think such an idea can be carried?

Asking a Man to Come Back

AL WAS absolutely correct in advising Ed to reverse his decision in firing this man, particularly when he found out that the man was innocent of the offense of which he had accused him.

The effect it would have had on the men would have been to confirm their belief that Ed was absolutely just in admitting that he had fired this man by mistake, but was big enough to admit his error, and at least ask the man to return.

I think in the event that this man decided to return, it would have a good influence on Ed, as it would possibly prevent him from making a like mistake the second time.

—C. B. COLE.

Making Foremen—or Importing Them

IN THE first place, Williams should know whether or not his foremen have understudies and he should know of their desirability as future foremen. In other words, foremen should be made before they are wanted.

Of course, in the best regulated shops, things will go wrong once in a while. Also, the position in question, a toolroom foreman, is a hard one to fill in an entirely satisfactory manner. With such a general policy in force, if a special case such as this occurs where there is no one in the organization who is able to fill the position, and good material can be located outside, I believe that it is better to import the man. However, the fact that the outsider may have some new ideas should have little or no consideration, as other and more extensive means should provide for that. —GEO. B. JENNE.

Handling Bar Stock to Keep Screw Machines Busy

Photographs by courtesy of The National Acme Company

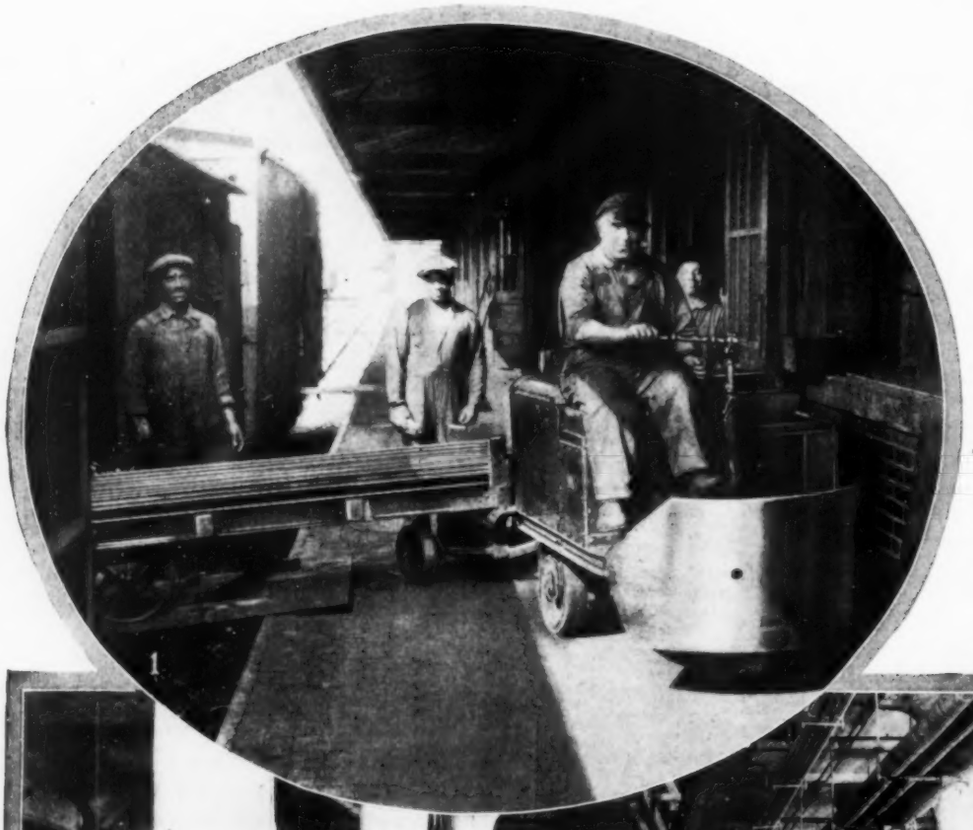


Fig. 1—Analysis of each shipment, and immediate unloading from the cars, are the first steps in preventing the screw machines of this plant from being held up for satisfactory material

Fig. 2—Approximately 25 car-loads of brass and steel bar stock are conveyed every week to this stockroom in readiness for the needs of the automatic screw machines. Wide aisles and plenty of trailers add flexibility to the system

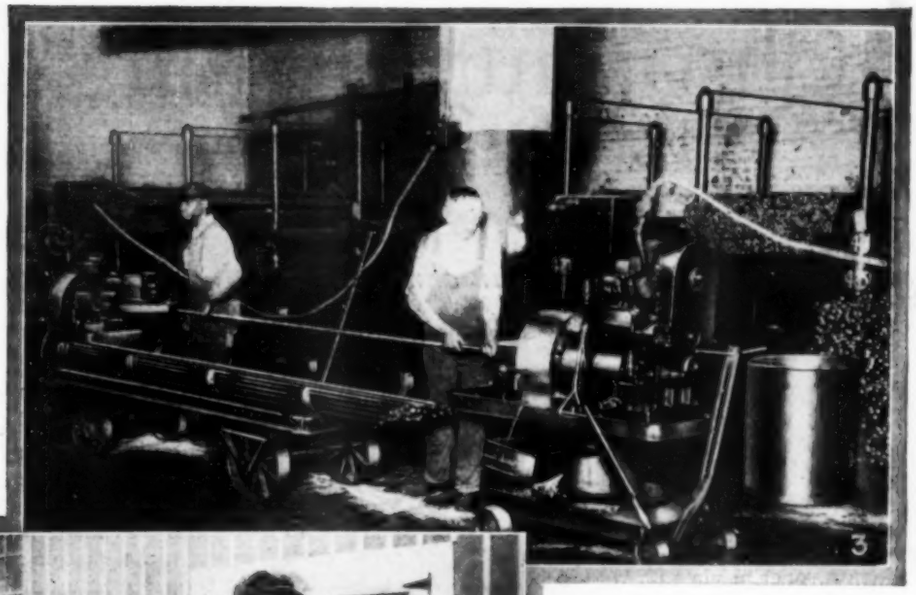


Fig. 3—When an order is received for stock this portable burring machine is drawn up beside the proper stock-bin, the ends burred, and the bars placed on the trailer

Fig. 4—The electric-mule and trailer combination provides a flexible and rapid means for handling both rush orders and the regular routine of keeping the machines turning out their thousands of parts

Fig. 5—Adequate supply space for each machine, and wide aisles for the electric mules and trailers, complete the provisions for keeping the operators of the several hundred automatics supplied with necessary raw materials

Chromium-Plating Progress

By W. M. Phillips
Factory-Production Engineering Section
General Motors Corporation

and

M. F. Macaulay
Oakland Motor Car Company

Difficulties encountered in chromium plating have resulted in greater attention being paid to plating operations in general

TRANSFORMATION of the plating industry during the last ten years has advanced the plating department to the position of being one of the most scientifically controlled in the automotive industry. The change can be traced directly to the public demand that the automobile companies plate the decorative parts so that they will resist tarnish and remain free from rust. When properly plated over nickel, chromium has increased resistance to rusting about three times that of a good nickel-plated surface. Since the successful plating of chromium on steel can be accomplished only after the part to be plated has first been properly plated with some other metal, such as copper or nickel, a short summary of the advancement of this part of the industry is necessary before discussing the advancement of chromium plating, because it shows how great a part the introduction of chromium has played in the notable advancement of plating. Plating was done almost entirely in manually operated tanks 10 years ago. Each plater had his own pet theories. If the plate began to go bad he would treat it with some chemical and, if that did not cure the trouble, he would try another, feeling that if it did no good he was no worse off than before.

Increased production of a better plating job by putting more nickel on the parts was impossible with the existing plating practices. Some new kind of equipment had to be designed, whereby more parts could be plated in the floor space then occupied by the tanks, and new plating solutions had to be found so that greater current-densities could be used and the same or a greater amount of plate deposited in less time. This need led to the development of semi-automatic plating equipment, and the use of hot solutions with moving cathodes.

The semi-automatic plating machine is designed so that the work is loaded and unloaded at the same end. The operator hangs the part to be plated on a conveyor which carries the part around the tank through the solution in a definite time-cycle. Using hot solutions and moving cathodes, the current densities were increased from 10 to about 40 amp. per square foot and, for the same amount of plate, the time of plating was reduced by 33 to 50 per cent. These accomplishments meant much to the industry, but many undesirable factors still existed where the management depended upon the human element. The time for all operations previous to plating were under the control of the operator, who could slight any one, and thus produce inferior plate. No inspection of parts was made after buffing the copper plating and before nickel plating; so most parts were buffed through the copper plating and down to the base metal. It is in these spots, where only a comparatively small amount of nickel covers the base metal, that rust first occurs.

Proper polishing of the base-metal prior to copper plating, followed by uniform coats of copper and nickel, and a thorough polish on the nickel, are among the preliminary operations that must be handled in a standardized manner if uniformly satisfactory chromium plating is to be obtained on the completed job.

With production steadily increasing and still greater demands for quality work, the industry sought another answer to the problem. The full-automatic plating machine, which carries the work from the final polishing operation through ten or more consecutive operations of cleaning, rinsing, copper plating and nickel plating, without having an operator touch the work until after it has been fully nickel plated and ready for the nickel-buffing operation, was then developed. The time on each operation was predetermined, and could not be varied by the operator. This resulted in a uniformly plated article that had an even coat of copper underlying the nickel. In addition to the improved quality of plate, production increased and a still greater saving was made in floor space.

Before discussing the development of chromium-plating methods, the following summary of nickel-plating methods is presented, using the copper plating and nickel plating of 1,500 radiator shells per day as a basis.

Kind of Equipment	Floor Space Required, Sq.Ft.	Number of Men
Manually-Operated Tanks	7,902	18
Semi-Automatic Machines	1,634	9
Full-Automatic Machines	1,040	2

When the cost of handling and trucking the radiator shells between buffing operations and the actual buffing costs are taken into consideration, the saving made in favor of the full-automatic machines is much greater.

In the early test work on chromium plating we were able to make satisfactory solutions by dissolving chromium anhydride, CrO_3, in water to which was added a small amount of chromium sulphate. These solutions worked only for a short time, and then no more parts

Abstract of paper presented before the Production Section of the S.A.E. at the annual meeting, Jan. 15-18, in Detroit.

could be plated with them. We found, after many tests, that this was caused by impurities; for the most part by chromium sulphate. It was then decided to use chemically pure chromic acid for the solution, at a price of 74 cents per pound. However, a sulphate content proved to be only one of our troubles. We found that the temperature and current density used were exceedingly important factors. A proper combination of these two, provided the part had been properly cleaned and that the plating solution was right, produced a hard, smooth deposit, with sufficient luster so that no buffing was required. Unless the underlying plate of nickel had been deposited from a slightly acid nickel-bath all the nickel would be pulled from the part. We learned that proper cleaning of the nickel was essential because, if the solution was too strongly alkaline, the chromium either deposited with irridescent blotches or as a gray burnt deposit, or else peeled. We decided that, if we were to sell chromium plate to the public, we would have to do better polishing work on the base metal and better buffing work on the nickel. A rough polish was magnified by the chromium, giving the part a grayish appearance rather than the true blue-white of chromium, while poor nickel buffing produced dull spots. The percentage of sulphate in the bath plays a very important part in the resulting plate, in regard to the color and to the throwing power, that is, the ability to plate into recesses. As a sulphate determination in the laboratory takes 12 hours, a production department would be in constant trouble if it had to wait for this analysis to be made. From the production standpoint, the correction can be made in only one way; that is, by the trial-and-error method. The temperature and the current density must be maintained constant to obtain consistent results. Increasing the amount of current at the cathode produces a satin or matt finish, while raising it further will produce a flaky, burnt deposit. A bright plate is obtained only under certain conditions of temperature and current density. Since the temperature of all parts of the piece in the bath is the same, the parts getting low current density at any one temperature may plate bright, but those getting high current density may be burned. If the current density is lowered by increasing the resistance or lowering the voltage to decrease burning at the high-current-density areas or the protruding points, the low-current-density areas may not plate. From this it can be seen that an irregularly shaped object, or one containing holes or indentations, is difficult to plate. This is now partly overcome by shading the high current-density areas with a screen and raising the current density sufficiently to plate the low-density areas or recesses. Too high a temperature gives a bluish soft plate. All chromium-plating solutions are controlled by automatic thermal regulators which maintain the temperature within 2 degrees.

Unless the underlying nickel plate is good, the nickel is very likely to peel after a minute or less of chromium plating. To chromium plate a piece less than 400 amp.-min. with an efficiency of not less than 12 per cent seems to us to be slighting the job, because it will not stand the polishing that some over-zealous car owners may give it. The only excuse for plating in less time is to obviate peeling the nickel, which, if properly plated, would not peel in 20 min. of chromium plating. But, it has been definitely proved by tests that any plate of more than 500 amp.-min. weakens the chromium-plate resistance to rusting rather than improving it.

Proper polishing is one secret of successful plating, as the ultimate finish is no better than the finish given to the base metal. To eliminate the polishing costs would decrease the total finishing cost by about 75 per cent. This is the aim of all manufacturers and they have met with success in some instances. One large company presses the parts from highly polished steel, keeping the dies in such condition that no polishing is required after forming the piece. Great advancement has been made in polishing methods because of the adoption of automatic polishing machines, and even greater accomplishments will be made in the coming years. Successful polishing, however, has its beginning in the drafting room, as the cost of polishing depends largely on the design of the piece. Wheels of very large diameter are more economical to use than wheels of small diameter. The part to be polished should be designed, therefore, to eliminate all unnecessary projections, depressions, angles, recesses or reverse curves, which can be polished only with narrow small wheels at excessive cost. Good polishing is dependent upon the absence of vibration. Manufacturers of polishing lathes have made great improvements in the last year in the design of these machines. Lathes are now motor driven through rope drives by fully inclosed ventilated motors. The spindle size has been substantially increased, and four $\frac{3}{4}$-in. diameter ball-bearings now take the place of the two $\frac{1}{2}$-in. ball bearings formerly used. As vibration greatly affects the finish and materially adds to the fatigue of the operator, this is an important development. Each manufacturer has his own problems regarding proper polishing operations, but remarkable strides have been made in this respect in the last few years. The standardization of emery grain sizes now being worked out by the General Motors Corporation and the abrasive manufacturers will mean much to the polishing industries. Then, and then only, will a manufacturer know that when he orders any certain size of grain, he will receive that size.

Substitution of automatic plating machines for manually-operated tanks has greatly reduced the floor space and number of operators required, and has resulted in a uniformly higher quality in the final chromium-plated job that would be impossible to obtain by means of the old manual methods.

The type of anode to be used in a chromium-plating solution has been subject to much discussion. Chromium, iron, steel, lead, aluminum and various other anodes have been recommended as being best suited for regular production work. We found chromium unsatisfactory, because it went into solution, thereby increasing the resistance. Aluminum also was unsatisfactory, as it is rapidly attacked by the plating bath. Lead and steel were both satisfactory; but, as the latter is the metal generally used for the tank, it was more satisfactory because the tank

could be made the anode. Lead, after being used as an anode on a production tank, is covered with a coating of lead chromate. This causes resistance to the flow of current and thus lowers the cathode efficiency. Considerable experimental work indicates that the type of steel best suited as an anode is one of low carbon content, fully annealed. Alloy steel, such as silicon and chromium steels, are soluble and therefore are not as satisfactory.

Inspection Methods

The proper inspection of chromium plating is important. The methods vary in different plants, but the main problem for the inspection department is how to make certain that the part has been chromium plated completely. This can be determined in the laboratory by various methods. Two of the common methods are to place the chromium plated article in an acid copper-plating bath where copper will deposit on all exposed nickel surfaces and will not deposit on the surfaces covered with chromium; or to subject the piece to an atmosphere of hydrogen-sulphide gas; all nickel surfaces will then immediately show up black, but the chromium remains unaffected. But laboratory methods cannot be used for a production inspection. The only way the surface can be inspected for coverage is by visual inspection and, as this depends for its success largely upon the lights used, it is important that the part be uniformly lighted so that the slight color differences of nickel and chromium can be distinguished. Daylight is ideal, but most factories are constructed so that the use of daylight is impossible and it is necessary to use artificial light. The Society of Illuminating Engineers recommends that a half-cylinder 18 in. long and 18 in. in diam., painted flat-white inside, be suspended from the ceiling. The interior is lighted from a small trough, or cave, containing a 200-watt daylight lamp. The cut-off of the trough falls inside of the drum. The claim is that the slight color differences between nickel and chromium can thus be detected.

Chromium Plating to Reduce Wear

The use of chromium for mechanical applications has been growing rapidly. Today we find chromium being used to plate such parts as plug gages, thread gages, snap gages, broaches and steady-rest rollers, to obtain greater resistance to wear. In plating plug gages, we have found the life of the gage increased to at least three times that of an ordinary gage. In the case of thread gages the life has been doubled. Broaches used to broach the babbitted end of connecting rods have been chromium plated, and we have been able to produce more than five times the number of rods per broach that can be produced with a regular production broach.

This branch of chromium-plating, as well as that for decorative purposes, is just in its infancy. Further uses for chromium are evident daily, and problems are being solved as rapidly as they come up.

Forcing Half-Inch Depressions in Cold Steel

R. E. Marks

HUBBING, or hobbing, for it is known under both names, is a process that, while used extensively in some lines of work, is too little known in others. It seems logical to refer to the process as "hubbing," not only because Webster says so, but also to distinguish it from the better known hobbing process as applied to gear cutting. But regardless of the name, it is something of an eye-opener to see a steel hub, which is really a sort of special punch with more or less intricate designs on its face, forced into a solid block of steel—*cold*.

Experts in this limited line say that a hub can be forced in for $\frac{3}{4}$ in. if enough pressure is applied, although in actual practice $\frac{1}{2}$ in. is about as much as we find, with $\frac{3}{8}$ in. much more common. Molds for radio dials, for knobs of all sorts, and the many products made of the phenol-resins, commonly classed as Bakelite, are made by the hubbing process.

The hub, or punch, is made of a tough, high-grade steel, while a low-carbon steel is used for the die. Usually the whole job of hubbing can be done at one operation, but it is sometimes advisable to anneal between squeezes. The pressure required varies according to the amount of metal to be displaced, also whether the die block is confined in a heavy steel ring or is free to flow sideways as well as down. In the former case a pressure of 100 tons per sq.in. may be necessary, while half this pressure will generally suffice if the die can spread as the hub is forced down.

There are several little points that must be heeded to make a satisfactory job. The face of the die block must be smooth and polished to secure the best impression, and the surface of the finished die has a beautiful polish that does not rust readily. The die blanks are annealed by heating to about 1,400 deg. F., and allowed to cool down in the furnace.

Some idea of the pressure and the tendency of the blank to spread sideways is had from the rings used to hold the block while under pressure. For a die block 3 to 4 in. in diameter the holding ring is 12 in. in diameter and is made of soft steel, carburized and hardened. The hole is ground smooth so as to get the die out more easily after hubbing. The hub, or punch, is hardened as nearly glass hard as possible and not drawn.

It is much easier to make a depression in the die than to raise letters or other parts by forcing them up into the punch. Designs for hubbed dies should be made with this in mind.

Dies and Lubricants for Cold Drawing

COLD-DRAWN shapes of steel, such as blades for turbines, are usually hot rolled to within $\frac{1}{32}$ in. of finish size. Before cold drawing through the dies they should be pickled in a hot solution of sulphuric acid, usually a 3 per cent solution. This pickling sometimes affects both high-carbon steel and alloy steel unfavorably, having a tendency to pit the surface. A little rock salt added to the solution is said to prevent pitting.

As with other drawing dies for steel the entrance and exit sides are tapered away from the central or drawing portion that forms the desired shapes. An entrance angle of 12 to 15 deg. on each side is usually satisfactory. The straight portion should be long enough to prevent undue wear, approximately one-third the thickness of the die being common. Either soap powder or a good wire-drawing grease is used to lubricate the die. Some find the soap powder preferable where the drawing is difficult.

Milling in the Moncton Shops of the C. N. R.

By Fred H. Colvin
Editor, American Machinist

Examples of milling work being done in the toolroom in the manufacture of small parts, and in heavy machining operations in a modern railroad shop

As an example of toolroom manufacturing in a large railroad shop, the making of tube expanders as shown in Figs. 1 and 2, is perhaps typical of modern practice. These two views of the same operation show the set-up of the universal milling machine, as well as the special fixture used for holding the tube-expander heads while being slotted. The construction of the fixture itself is best shown in Fig. 1. A single forging of rectangular steel serves as a fixture to carry the three mandrels on which the expanding heads are held for slotting. The gears at the back end control all three spindles, a universal joint extension fitting into a three-jaw chuck on the indexing head, as shown. The other view, Fig. 2, shows three expanding tools after the last slot has been cut.

Another milling operation, in which the indexing head plays its part, is shown in Fig. 3. Here the square on the end of the shank of a taper tap is being milled, using a vertical milling attachment that has been swung into a horizontal position. The tap is held on centers, and is kept in position by a long screw through the ring on the indexing head faceplate, the point of the screw fitting into the flute of the tap. Two other somewhat similar jobs are shown on the milling-machine table in front of the tail center.

A small manufacturing operation is shown in Fig. 4, where about thirty jaw connections for bell ringers are milled at one setting. Several of these jaws are shown on the table under the overarm, while the fixture itself is shown under the milling cutter. The jaws of the fixture are held by substantial side plates, and are clamped at the ends by the bolts shown. Operations of this kind indicate that careful attention is being paid to manufacturing costs.

Beading tools for boiler flue work are part of the equipment of every locomotive shop. The method of making these in the Moncton shops is shown in Fig. 5. The fixture in which the tools are held while being milled is clearly shown. It consists of an angle plate carrying a swinging tool block to which the beading tool is clamped by the strap shown. The tool-holding block swings in the upper end of the angle plate, its movement being controlled by a worm and sector. The radius secured depends on the position of the tool that is being milled with relation to the center of the trunnion on which it swings. A formed milling cutter, as seen on the arbor, completes the working end of the beading tool at one operation. The tool-holder can be swung through its arc, either by hand, using the squared front end of the worm, or by power through the indexing head, using a universal joint connection.

An entirely different milling operation is shown in Fig.

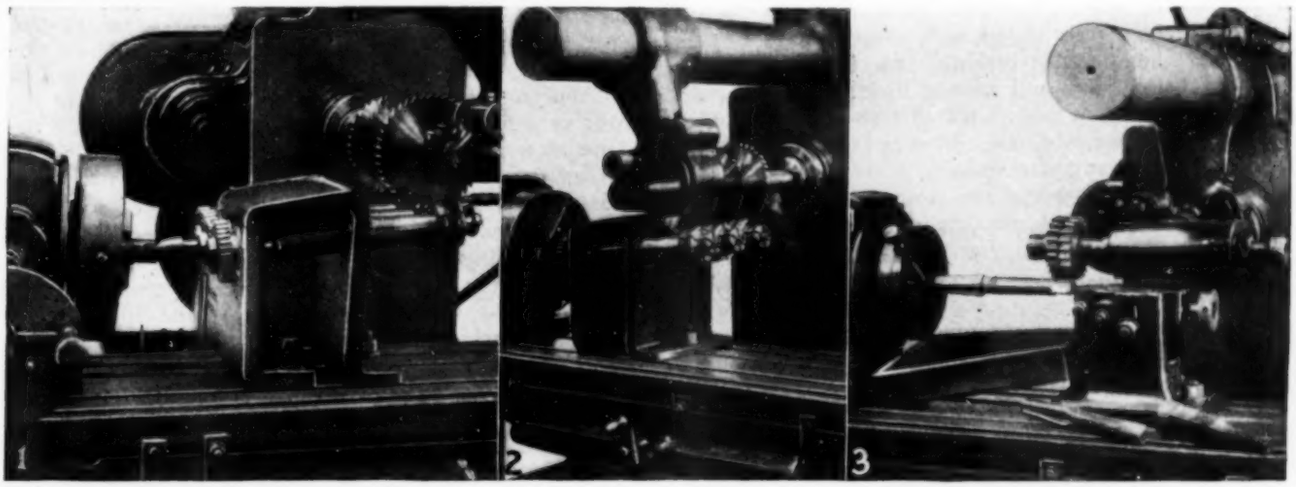
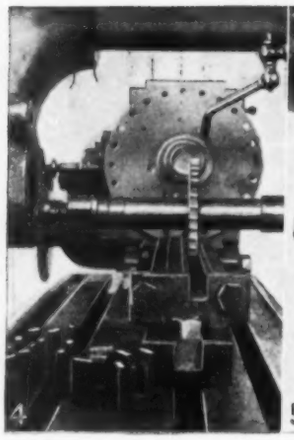
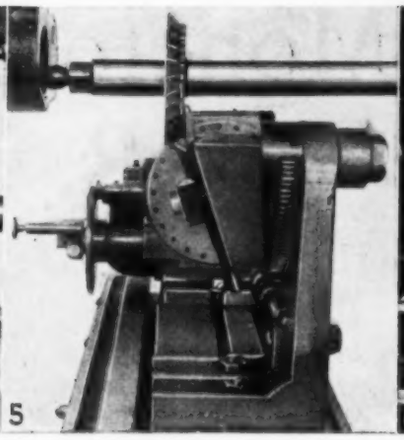


Fig. 1—Fixture for milling three flue-expanding tools at one setting. Fig. 2—Another view showing three expanding tools that have been slotted at one setting. The center spindle is connected to the chuck on the dividing head, so that all three spindles are indexed at the same time. Fig. 3—Milling the square end on the shanks of taps and other tools. This set-up utilizes a vertical milling attachment, swung into a horizontal position. The tap is held by the long screw that bears in the flute. Two similar pieces are shown on the table





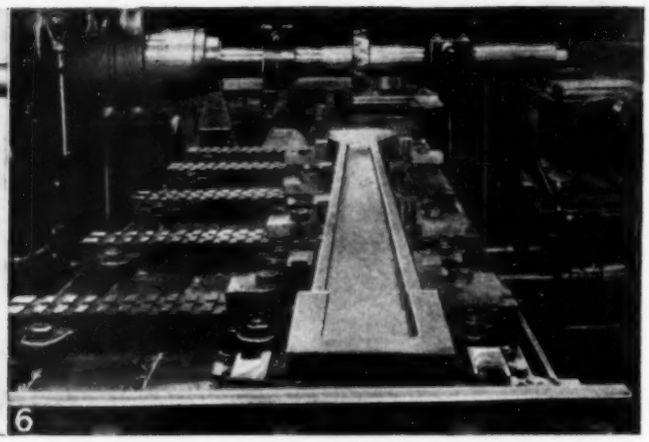


Fig. 4 — Milling the slots in thirty bell-ringer jaw fittings at one operation. These jaws are clamped endwise by a through bolt on each side. Fig. 5 — Fixture for milling the throats of flue beading tools. The tool is held in such a position as to give the proper radius when the holder is rotated by the worm and segment. Fig. 6—Milling a large connecting rod. Setscrews in each clamp bear directly against the rod being milled, and no parts of the clamping devices project above the surface of the rod

6, where a large main rod is being channeled on a heavy, planer-type milling machine. The rods are held by clamps that fit into the grooved cross pieces mounted on the milling-machine table. Set-screws through the jaws of these angular clamps hold the rods from each side, and it will be noted that the rod is held in place with no part of the clamps extending above the upper surface of the rod. Although the illustration shows only one rod in position, other rods can be clamped at the same time and milled in one operation.

Salvaging Parts by Chromium Plating

By R. E. Marks

CHROMIUM plating is best known by its application as a finish that retains luster and prevents rust or corrosion of various kinds. It has, however, many other uses and the experience of a large plater over a four-year period is of interest, especially as this experience involves the use of "strike" coats so thin as to be difficult to measure, and heavy plating up to deposits of 0.008 in. in thickness.

Among the applications that have proved of unusual interest are bearings plated with chromium to increase their life; building up bearings that had been ground or worn below size; and coating molds for rubber and other materials. Molds so plated give a high luster to the molded object, are easier to part after molding, and obviate the necessity of cleaning.

Another interesting application was to plate the friction surface of automobile brake drums, when chromium plating was a new process. Early tests indicated that the chromium-plated brake drum would outlast the car, and maintain full brake efficiency during its life. There seemed to be every indication that while the brake linings would require replacement periodically, the chromium-plated drum would last indefinitely.

Succeeding experiments, however, indicated that unless the chromium plating was perfect the method was not at all satisfactory. Any tendency of the plating to chip, or for the surface under the chromium to come loose at any spot, would result in small slivers of metal becoming inbedded in the plated surface, and tear both the brake lining and the plated surface itself. Properly applied, however, chromium-plated brake drums give fine service.

In the building up of undersized bearings, gages or other worn parts, the advisability of chromium plating is simply a matter of justifying the cost. If it will cost more to scrap a part which is undersize than it will to plate it, chromium plating will pay and has the advantage of giving a very hard wearing surface. If the part can be replaced cheaply, it may be wise to scrap it.

Generally speaking, it may be said that where the cost of parts to be scrapped is over $5, with a uniform variation from standard of not over 0.003 in., it will pay to salvage by chromium plating. For where the variation is uniform, plating will build up accurately to the desired size. Where this is not the case an extra thick plate must be applied and the proper size secured by grinding or lapping. Practically all metals except aluminum and die-cast mixtures have been successfully plated.

The Importance of Quality

By Frederick Kampmeir

TO ALL progressive machine manufacturers, the quality of material used in manufacture is a more important consideration than the quantity. Not so long ago the importance of quality of material used in machine construction was of minor importance. Shop men and designers knew only a few materials and their answer to a mechanical failure was to place more of the same material into the part rather than search for a stronger material.

However, experience and careful analysis of construction materials have taught machine builders the advisability of using a stronger material for a weak section instead of using a greater amount of the original material.

Another improvement following in the footsteps of advanced machine building is the substitution of material. This is current practice now. When the foundryman declined to be as progressive in his methods as the circumstances demanded, his customers turned to pressed metals and the various forms of welding.

To make a practical success of these various innovations it was necessary to learn the basic principles involved — a task for the engineer and the scientist. Careful investigation, experimentation, and analysis of material used has led to the establishment of the new era of quality.

Inspection of Micrometer Spindles *at the Zeiss Works*

By Henry Simon
Jena, Germany

Testing the lead of a micrometer spindle thread to 0.00005 inch by combined linear and angular measurements

THREADS of Zeiss micrometer spindles are cut with straight threading tools in one roughing and one finishing operation on special lathes, which are provided with means for relocating the cutter accurately. The correct shape of the cutting tool is maintained by sharpening it in a jig with a diamond-charged copper wheel, held in such a manner that it reproduces the thread angle with a high degree of precision. Under these conditions the true thread form and pitch diameter are maintained easily, and the inspection centers mainly around the lead of the spindle threads.

The Zeiss micrometers are guaranteed not to vary more than 0.000125 in. in a length of 1 in. This tolerance may be all plus or all minus in the same screw, as long as the total variation does not exceed the guarantee. The shop inspection tolerance is about 80 per cent of this amount, or one ten-thousandth of an inch, which is sufficient for all practical purposes.

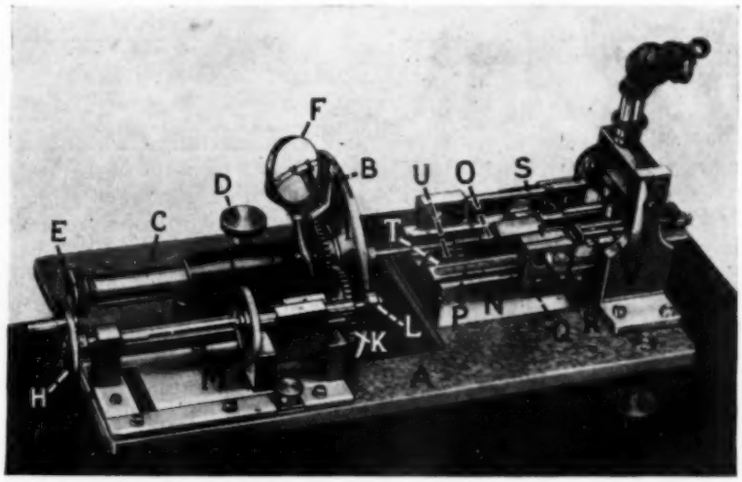


Fig. 1—General view of Zeiss lead-testing machine

In the final test of the assembled micrometers, each tool is checked against standard plugs in a number of spindle positions, but only about one out of every ten is given a shop thread inspection. If it is found, however, that one of the finished micrometers shows an error greater than that permitted by the limits, all of the spindles in the last batch are tested, and all defective ones are thrown out.

An analogy between the lead-testing machine herein described and a micrometer may be drawn. Both have a scale for linear measurement, and the faceplate of the testing machine is similar to the barrel of a micrometer in that both are used for measurements of fractional parts of the scale divisions. The spindle to be tested is placed between centers and driven by the faceplate. Revolving the faceplate causes the spindle threads to advance a slide upon which is an extremely accurate scale graduated in fractions of the lead of the thread. This scale is read by means of a microscope having two parallel hairlines. These lines are adjusted to straddle a numbered line on the slide scale. The faceplate, which is graduated on its periphery, is then turned one or more revolutions until the two hairlines of the microscope again straddle a given line on the slide scale accurately.

This reading is compared to the angular position of the zero on the faceplate. If the lead is true, the zero on the faceplate will coincide with a corresponding zero on the pointer. On the other hand, if the lead is not true the position of zero on the faceplate will indicate the degree of error of the lead.

The machine, shown in Fig. 1, consists of a flat base *A*, in which a central gap separates the driving and measuring mechanism at the left from the driven scale-bearing slide at the right. The former is composed of a faceplate *B* running on a stationary shaft *C*, which may be held at different points of longitudinal adjustment, to suit various spindle lengths, by means of the screw *D*. Located in the bore through shaft *C*, is the head center which is also stationary, except that it may be pulled back by the knob *E* against the tension of a spring when inserting the spindle to be tested. On the rear face near the periphery of the faceplate, a scale is engraved. Each division has an actual length of about $\frac{1}{16}$ in., which corresponds to an advance of 0.0005 in. of the screw being tested. For greater convenience, a magnifying mirror *F* is used to read off the motion of this scale along the pointer *G*. The faceplate is revolved by means of a handwheel *H* acting through gears *I* and *K*, and final adjustment may be made by a small friction wheel *L* connected to a disk *M*.

On the right-hand side of the machine, shown in Fig. 2, a bed block *N*, fastened to the base *A*, provides a socket for the tail center *O*, which revolves in a ball thrust bearing, and also for the scale slide *P*. Three-point support for the scale slide is given by three ball bearings *Q*, which are fixed to the inner walls of the bed *N*. Opposite each fixed bearing *Q*, and above the slide lip, is a similar ball bearing *R*, held in a lever *S*, which is pivoted at the opposite end in an upright block screwed to the bed *N*, and pressed by a spring towards

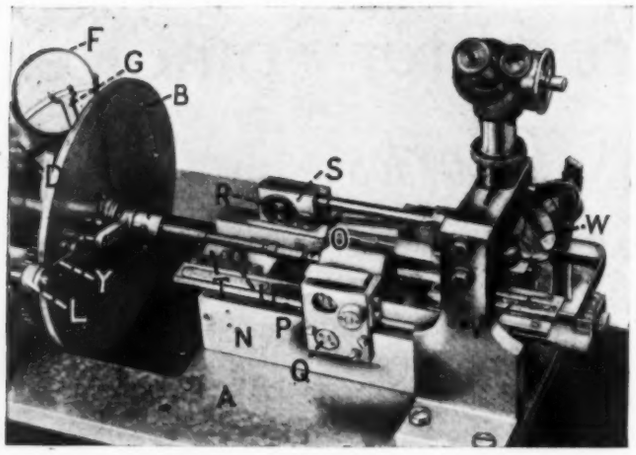


Fig. 2—Close-up of spindle and slide scale

the lower ball bearing. The scale slide is thus held in a manner that produces only a very small amount of frictional resistance, and one which remains practically constant under all conditions.

Connection between the micrometer spindle under test and the scale slide is established through a contact member consisting of a plate *T*, upon which a small removable block *U* and a quarter segment of internal thread are mounted. This segment is pressed upward, ordinarily, and into contact with the thread of the spindle being inspected by a spring underneath plate *T*, but it can be disengaged instantly by depressing plate *T* with the fingers. The detailed construction of the block *U* and thread segment is shown at *A* in Fig. 3. The segment, made of hard bronze, is soldered in place on block *U*. Exact alignment of the internal thread segment is assured by the special single-fluted tap shown at *B*, in Fig. 3. The tap is placed between centers, and on being revolved causes the slide with the thread segment to travel along it. This movement corrects any slight inaccuracy in the thread. Upon the opposite end of the slide is located the glass scale *V*, in a mounting that can be shifted quickly lengthwise of the slide by the fingers. The scale has fine adjustment by the thumb screw seen at the extreme right. The double hairlines in the microscope can be adjusted astride a line accurately by this means.

The graduations on the slide scale are so fine that they are invisible to the naked eye. Through the microscope they appear as in *C* in Fig. 3. These lines are only 0.005 in. apart, and by means of the "light-crack" effect obtained by straddling one of them with the parallel hairlines on the microscope, adjustment can be made to 0.00005 in. A point that deserves special mention is the fact that all parts having longitudinal motion are located in the same horizontal plane. Thus, the center of the thread segment, the lower faces of the slide lips, and the top of the glass scale are all on the same level. This construction prevents the introduction of angular errors.

The inspection procedure itself is simple and rapid. The micrometer spindle is clamped lightly in a special dog, *X*, and slipped into position by withdrawing the spring-actuated headstock center, after which the tail of the dog is clamped against lost motion by an eccentric lever *Y* on the faceplate. The thread segment on the slide is engaged near one end of the spindle thread, given one or two turns to insure its engagement, and brought to rest with the pointer *F* on zero. The double hairlines in the microscope are next adjusted central over a numbered division line on the slide scale. The faceplace is now revolved until another division on the slide scale appears centered between the microscope hairlines, and the reading of the faceplate scale taken. This is done by means of the magnifying mirror. The reading of the two scales will coincide, if the lead of the spindle thread is true. The deviation shown by the faceplate scale represents the lead error in the portion of the spindle thread just examined. By repeating the procedure, the entire length of the thread is gone over, the errors being registered by pointing them off on cross-sectioned record blanks. Experience has shown that readings at points about $\frac{1}{8}$ in. apart along the spindle will give a faithful picture of its condition.

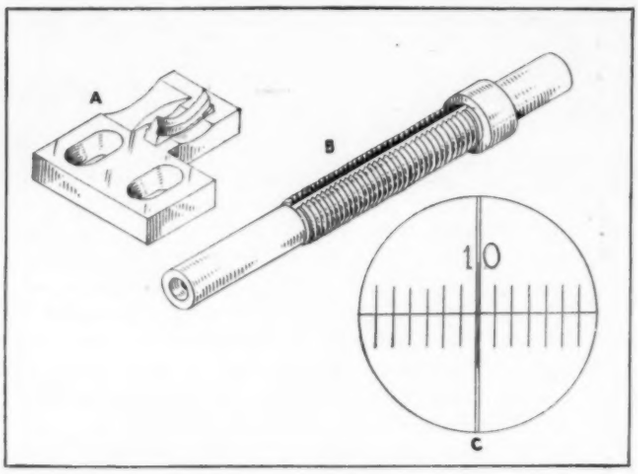


Fig. 3—Details of special tap, thread segment, and slide scale

In order to provide a convenient check on the machine, a number of test spindles, which have been verified by comparison with master standards, are kept on hand. One of these test spindles is run through the machine periodically in the regular way, its record showing instantly the existence and extent of any error that might have developed.

European Trade and American Industries

More and more in the decade since the War American manufacturers have given attention to foreign trade—not only as a field for sales of their products, but also as sources of raw materials. For such items as tungsten, manganese, tin, cobalt, and chromium, so important to the metal-working industries, we are largely dependent upon foreign fields.

To give a better understanding of our foreign trade relations, especially pertaining to those factors relating to the machinery industries the *American Machinist* has been publishing a series of articles by Dr. Julius Klein on trade conditions in European countries. The last of these articles, one on the French Empire of Trade, will appear next week. It will show the vast extent of that country's trade resources, and its relation to American industries both for sales of equipment and supply of materials.

Activity in the Metal-Working Industry

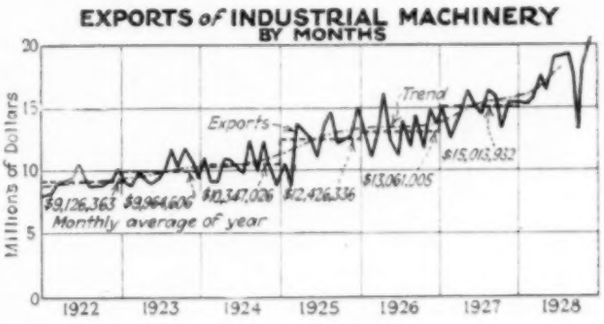
Decrease in Operations During December

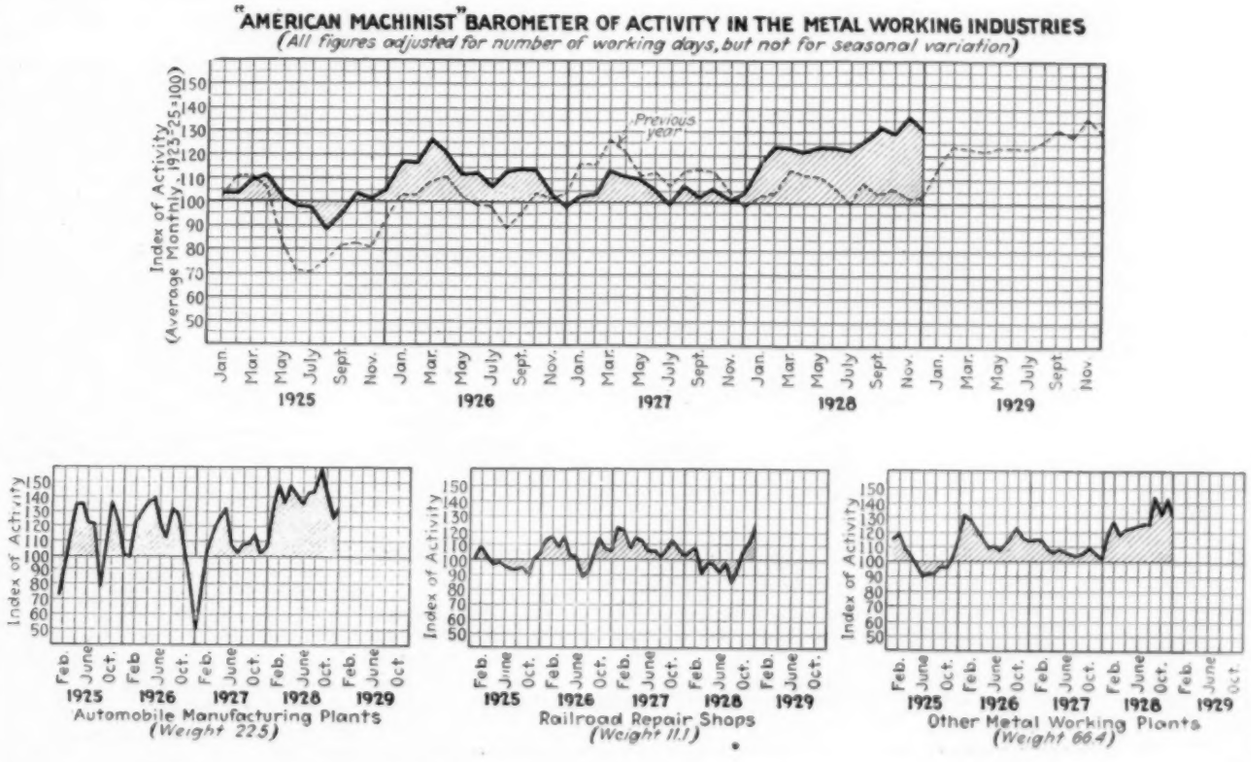
The rate of operations in the metal-working industry for the closing month of 1928 was materially less than that for November, but still about 25 per cent greater than that for December, 1927. The trend in operations started downward in October, but took an upward turn in November. It appears now that the November increase was only temporary, as December operations were about 4.4 per cent below those of November.

Incomplete returns on the consumption of electrical energy by automobile manufacturing plants, including those manufacturing repair parts, indicate that the rate of operations in these plants during December was about 2.2 per cent greater than during November, and about 22 per cent greater than during December of 1927. This industry is starting an upward trend which is normal at this season of the year. If the experience of past years is repeated, the month of January should show a materially increased rate of activity as compared with December.

Railroad repair shops maintained a December rate of operations above that during November, and at a rate some 25 per cent greater than during December, 1927.

The exports of industrial machinery during 1927 were the largest since 1921, the last year of the post-war boom period, according to preliminary information from the Industrial Machinery Division of the Department of Commerce. Metal-working machinery was a consistent gainer throughout the year. Exports of lathes increased from $2,989,000 to $4,085,000 for the first eleven months of 1928, over the corresponding period of 1927. For the same period, milling-machine exports increased from $1,233,000 to $2,080,000; drill-press exports from $845,000 to $1,499,000; and sheet- and plate-working machine exports from $1,268,000 to $2,567,000. The latter increase is more than 100 per cent. Water wheels and water turbines accounted for exports of $734,021, as compared with only $196,025 for the like period of 1927. The remarkable increase in machinery for utilizing water power is the natural result of a world-wide move for greater use of natural resources.




"AMERICAN MACHINIST" BAROMETER OF ACTIVITY IN THE METAL WORKING INDUSTRIES
(All figures adjusted for number of working days, but not for seasonal variation)
Index of Activity (Average Monthly 1923-25=100)
Previous year
1925
1926
1927
1928
1929
Automobile Manufacturing Plants (Weight 22.5)
Railroad Repair Shops (Weight 11.1)
Other Metal Working Plants (Weight 66.4)

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· TECHNICAL · ABSTRACTS ·

A Review of 1928 Aircraft Design Development

A review of aircraft and engine design development during the year of 1928, with particular attention to the exhibits at the International Aeronautic Exposition held in Chicago, indicates that a degree of stability in designs has been attained. Refinement of existing designs rather than radical departure from conventional practice was noted at the last large representation of planes of the year. Many established manufacturers are now offering new models in the weight classes above or below those in which their original products fell, and many new planes, developed along accepted engineering lines, are being offered by newly formed companies. This is also true of the engine manufacturers and indicates that demand is taking definite shape, and that all of the companies are looking forward to increased production in 1929.

More Metal Used

One of the outstanding design tendencies of the year is the increasing use of metal in airplane manufacturing. Several of the new planes at the Chicago exhibit had metal wing structures. Although welded steel tubing seems still to predominate as structural material, a slow but persistent movement toward the use of light metals is noticeable.

More planes are now equipped with brakes and tail wheels than heretofore, according to indications at the Chicago Show. This is true not only of the heavy transport planes, but of the lighter commercial and sport craft. A number of the newer planes are equipped with folding wings, and can be stored in a small space. Generally speaking, streamlining has been improved, but visibility has been neglected in many of the newer planes, particularly the cabin monoplanes.

Most of the wing sections employed in the airplanes of the year have been standard curves or modifications of the known airfoil sections. Despite the fact that a large percentage of engine failure is due to fuel line difficulties, little has been done to improve this vital part of the plane.

Many of the small planes were designed originally for the Curtiss OX-5 engine and, when demands for higher performance were made, the J-5 Whirlwind has been substituted. This change produced very desirable performance, but necessarily placed the planes in a higher price class. The demand for a lower-priced plane has persisted and, with the diminishing supply of OX-5 engines, manufacturers have been faced with the necessity of obtaining an engine of approximately 100 to 150 hp. and several new engines were developed recently to meet this emergency. Foreign power plants have been imported and, in some cases, licenses have been obtained to manufacture them in this country. The instability in this important matter can easily be seen, when it is noted that the planes of this class are now offered with Comet, Curtiss, Hispano, Kinner, Siemens, Walter and Warner engines, as well as the Whirlwind and OX-5 installations. This chaotic condition is hindering quantity production and complicating distribution.—*Aviation*, Jan. 5.

Effect of Furnace Atmospheres on Steel

Intelligent use of raw gas, independent of that consumed through the burners, offers possibilities of extremely flexible conditions of furnace atmospheres and is, therefore, a valuable adjunct to the heat-treatment of steel.

It is a well-known fact that carbon monoxide, methane, illuminants, and other hydrocarbons, are carburizers. It has been found, however, that water vapor in combination with the above carburizing gases acts as a deterrent to their carburizing action, and that water is an oxidizer, first of the iron, and second of any available carbon. It becomes apparent that to attempt to hold a non-scaling, non-decarburizing atmosphere in a gas furnace may best be accomplished by leading a jet of raw gas into the chamber independent of the burners. We have found that atmospheres ranging all the way from scaling (oxidizing the iron) and non-decarburizing to non-scaling and carburizing, or any intermediate condition, such as non-scaling and neutral (as regards carburizing and decarburizing), may be secured at the will of the operator.

In the discussion, R. L. Manier stated that, in performing gas carburizing, he had found some jobs were perfectly satisfactory, but others were not. Those jobs which were perfectly satisfactory were far distant from the gas holder where the relative humidity would tend to remain quite constant, while the jobs that were giving trouble were those within a block of the main gas holder where the gas, after coming in contact with the water, varied decidedly with different temperatures during the season. Indications so far are that, if the gas is dehydrated and the material properly prepared, gas carburizing will prove very satisfactory for the work.—R. G. Guthrie, *Trans. A.S.S.T.*, January.

Stainless Steel for England's 5,000,000 Cu.-Ft. Dirigibles

The two 5,000,000-cu.ft. rigid airships now being built in England, though smaller than the ships recently ordered by the U. S. Navy, are far larger than any airship hitherto built in any country. They are of special interest in that they embody marked departures from all previous rigid airships in details of construction.

The general design of the R 101 was developed by the Royal Airship Works, a government establishment, but, in order to cope with the details of design, it was felt necessary to call in Boulton & Paul, Ltd., a concern experienced in the use of high-tensile steel for aircraft construction.

A feature, which is quite outside the range of Zeppelin practice, is the use of screwed couplings for joining consecutive lengths of girder together. The frame members are jig-built, require no fitting in place, and are easily removable and renewable in case of local damage. The R 101, which is now being assembled at the Royal Airship Works at Cardington, Bedford, England, is a more radical departure from conventional airship practice than is the R 100. In the first place, steel has been used in preference to a light alloy for all of the more heavily-stressed components of the frame. Secondly, the transverse frame rings have no radial wire bracing, but are designed to possess sufficient inherent stiffness without such aid.

The abandonment of duralumin in main structural members was dictated by the possibility of intercrystalline corrosion, and by the belief that recent developments in the manufacture of airplane structures from high-tensile steel strip would allow this material to be used without any increase in the weight of the structure. The facts that stainless steel can be worked to sections of the required characteristics, and that the corrosion bogey can be overcome, were dominant factors in coming to this decision.

The stiff transverse frame rings were adopted in place of the more usual type to avoid the very heavy compression loads transmitted to the frame girders by the radial bracing, when subjected to unequal gas pressure in adjacent gas compartments. This condition is caused by deflation of one bag or by a large angle of pitch on the ship as a whole.

The R 101 is approximately 730 ft. long and has a maximum diameter of a little more than 130 ft. Over the greater portion of the length the section is a polygon of fifteen sides, but at the tail, the section changes to a polygon of 16 sides. There are eleven main transverse frames, two lighter nose frames of 15 sides each, and three 16-sided frames at the stern. Each of these frames consists of three sets of girders running parallel to the faces of the sides of the polygon, and tied together with radial girders, and by short sections of longitudinal girders to form a ring-like structure, triangular in cross-section. The longitudinal girders are in sections about 45 ft. long overall, and fit between the short sections of similar girders, which form part of the transverse frames.—*Aviation*, Dec. 29.

IDEAS · FROM · PRACTICAL · MEN

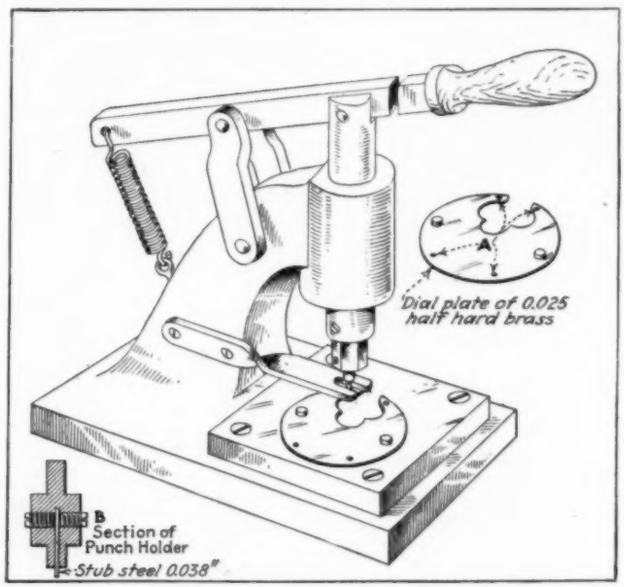
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Punching Small Holes in Hard Brass

By Charles H. Willey

By substituting a hand punching operation for drilling, we have eliminated an expensive item of drill breakage. The work to be done is piercing four small holes 0.040 in. diameter, as shown at *A* in the illustration, in a half-hard brass dial plate 0.025 in. thick.

Previously, we had tried drilling these plates in both open and closed types of jigs, but the drill breakage was



Punching holes with a hand punch

so great that we gave it up and changed over to punching the holes by the method shown.

We designed a punch holder *B* to take straight stubs steel or piano wire punches, and to hold them with two small setscrews, so that in case of breakage they are renewed readily.

We find that a punch is good for from 2,000 to 3,000 holes, after which it is replaced at a fraction of a cent, compared to $0.10 for each drill. We have also made a saving of 15 per cent in time over the drilling operation.

Two Railroad Testing Fixtures

By Frank C. Hudson

Superheater units have become a part of almost every locomotive boiler, and as it is necessary to have tight joints at the ends of the piping, it is found advisable to test these units before installing them in the boiler. In order to handle these units easily and quickly, the device shown

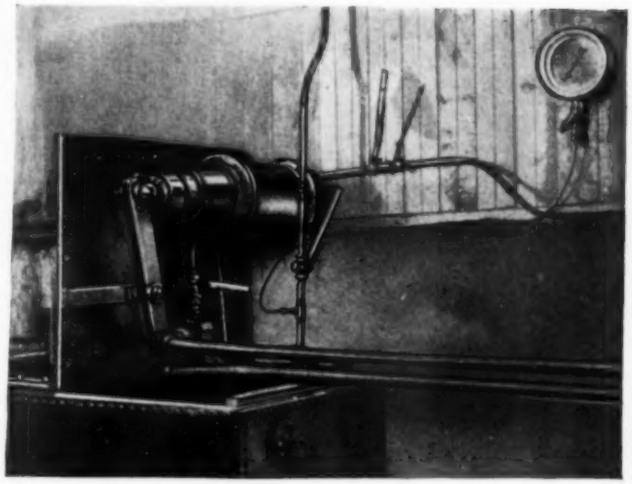


Fig. 1—Testing rack for superheater units

in Fig. 1 was designed and built in the shops of the Canadian National Railways, Moncton, N. B. The test rack consists of a suitable tank having an angle plate near the center as shown. On this plate is mounted a brake cylinder that operates the vertical lever, which in turn is pivoted on the pin shown just below the center. The lower end of the lever is forged to the shape of a hook so that it will reach between the two pipes and bear against the clamp which holds the ends the proper distance apart. Admitting air to the cylinder forces the lower end of the lever against the pipe clamp, and holds

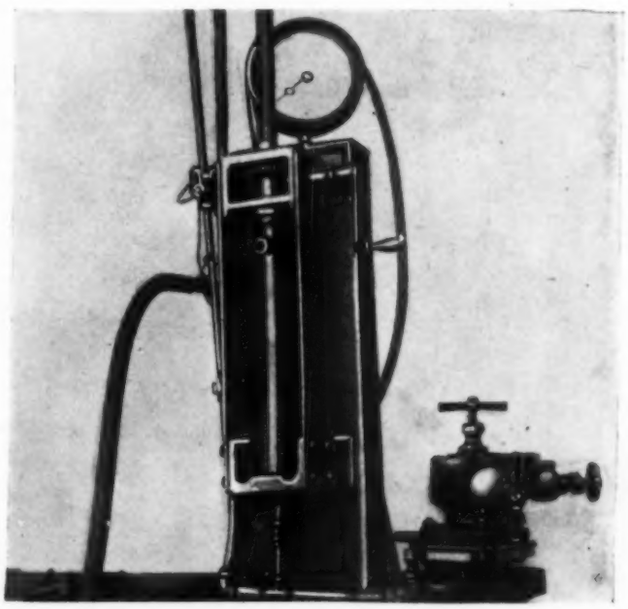


Fig. 2—Pressure-testing rack for valves

both joints firmly in position against the seat through which water or steam is admitted for the test.

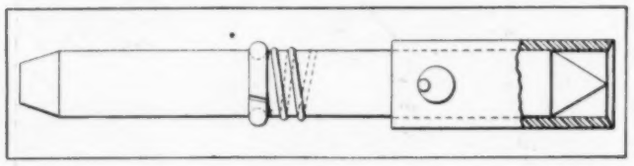
In the same shop is the test rack shown in Fig. 2, for applying hydrostatic pressure to valves of all types. With a valve in position as shown, water is admitted to the vertical cylinder from the pipe line at the left of the testing rack. The water is then shut off and the pressure is applied through the vertical screw which is operated by bevel gears and a crank. The gage at the top of the column shows the pressure secured.

A Spacing Punch for Diemakers

By John F. Bell

Another type of spacing punch which eliminates the necessity of drawing a line parallel to the die outline, is shown in the illustration.

The lower part of the punch is covered by a sliding sleeve actuated by a helical spring, and limited in its



Diemakers' spacing punch

motion by a stop pin. The spring is held in place by a split ring fitting into a groove in the body of the punch.

In operation, the device is placed on the die-block so that the outer edge of the sleeve coincides with the outline of the die. The punch is then struck with a hammer. All the punch marks will be equidistant from the die outline. Of course, it will be necessary to have the punch and sleeve of the proper diameter to suit the size of drill used in drilling out the center of the die-block.

Airplane Welding Operations

By D. B. Wedge

The modern airplane with its steel tubing fuselage, and its multiplicity of joints, finds in welding, an important tool. These joints, which are of many shapes and at many angles, are easily made by cutting the tube ends to suitable shape, and holding the pieces in position until welded.

Where production warrants, more or less elaborate fixtures are built to hold the parts in correct alignment, some of which I am hoping to be able to show at a later date. For experimental work, simple, but accurate methods are used. In Fig. 1 is shown a temporary fixture built up of angle iron and suitable for use with a wide variation of fuselage design.

The longeron, or upper tube, is held by the C-clamp at *A*, being positioned by the short angle *B*, and by the previously welded members. Another clamp at *C* is holding a short cross tube that forms the end joint of the two angular members. By placing the bracket *D* at other heights the angle of the joints may be changed to suit a wide variety of conditions.

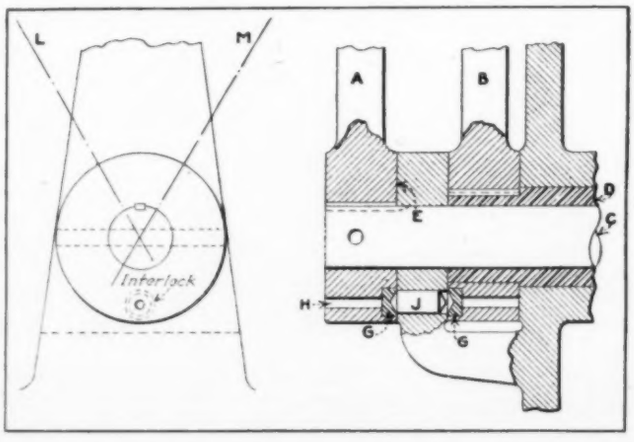
Two typical welds are shown in Figs. 2 and 3, the first being a junction of four tubes, with as many angles. This being a double connection joint at one corner of the fuselage. The other joint is even more complicated as the four tubes shown are not only joined together but also welded to a shaped steel plate behind the tube at the left. There is almost no limit to the variety of joints that can be made by the welding process. By its means constructions that would otherwise be extremely difficult are easily made.

Interlocking Device for Tanden Levers

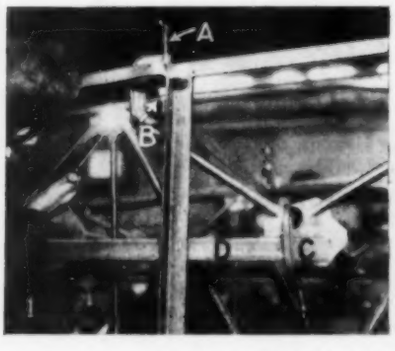
By Joseph E. Fenno

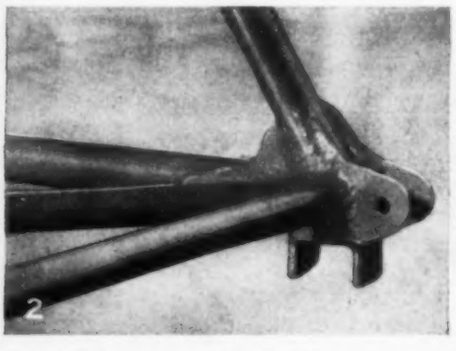
The construction of a special wire-forming machine was such that only one of its two operating levers could be shifted from neutral at the same time without stripping the teeth from some of its gears. The method of interlocking that was used to prevent this is shown in the illustration.

The levers *A* and *B* are fastened to the shaft *C*, and



Device to prevent two levers from being moved from neutral at the same time





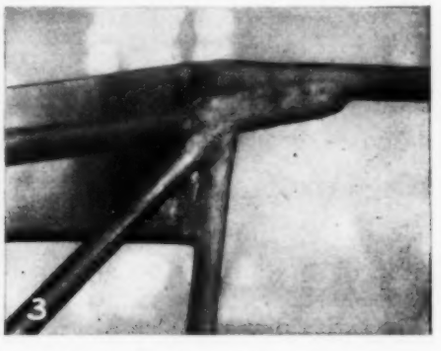


Fig. 1—Holding fuselage members for welding. Fig. 2—A corner joint with a connection fitting. Fig. 3—Where four tubes and a plate are joined together

sleeve *D*, respectively, and are separated by the bracket *E*, which is cast integral with the machine gear case. The tool-steel buttons *G* are pressed into their respective levers at the neutral position, and a hole *H*, is provided to facilitate their removal for any purpose.

The cone ended pin *J* is a sliding fit in the braket *E*, and its length is such that when one of its ends is engaged in the button of either lever the other end will just clear the button in the other lever. As shown, the pin *J* is engaged in the lever *A*, and the lever *B* is free to move to either *L* or *M* position. When the lever *B* is moved off the neutral position the smooth face of its boss, will prevent the pin *J* coming out the button on lever *A*, which therefore, cannot be moved until the lever *B* is back at the neutral position.

Using Four Radials Simultaneously in Railroad Work

By Chester H. Franklin

Radial drilling machines have a great range of usefulness as ordinarily erected. When they are mounted on a traveling base, their ability to reach otherwise inaccessible points is greatly increased. Add to this combination, a work platform that can move, and the acme of flexibility is not far away. Such a combination is to be found in the Huntington shops of the Chesapeake and Ohio Railroad. Four radials, instead of one, make up the unit for drilling boiler plates. The arrangement is shown, in the accompanying illustration, of four American radial drills in the boiler shop.

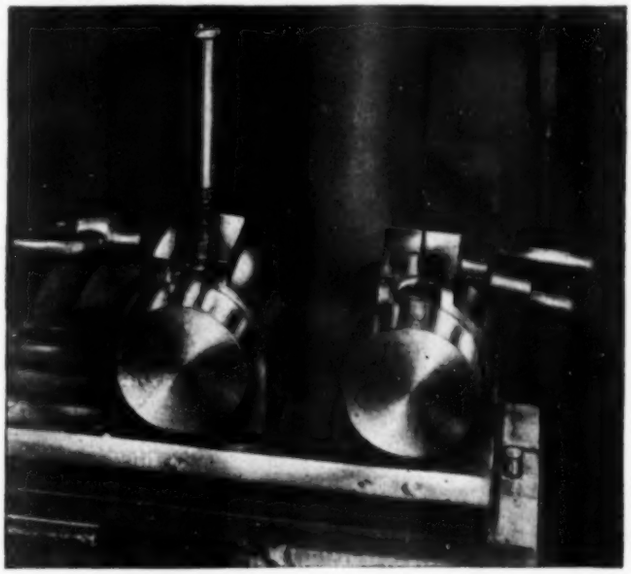
The two radials at the right are fastened to the floor. The other two are mounted on four-wheel trucks having roller-bearing wheels and a clamp at each corner to hold the truck at any desired point. With the combination of moving the sheet to be drilled, and the two movable drills at the left, any desired point of the plate can be reached. There are two work cars, each having a series of T-rails to support the plates between the holes. It is difficult to imagine a more flexible combination than this. The machines are motor driven, standard 6-ft. radials with the exception of the arm, which was lengthened 3 ft., in each case, to increase the reach. In addition to the moving table each machine has its own drill table, those of the movable machines being 26- and the other 20-in. high.

Finishing Piston Pin Holes by Burnishing

By Francis C. Henry

There are many methods of finishing piston pin holes, from reaming to grinding, with burnishing and diamond boring in between. Burnishing has long been a favorite method with many, the only objection to its use being the possible distortion of the piston from forcing the burnishing broach through it.

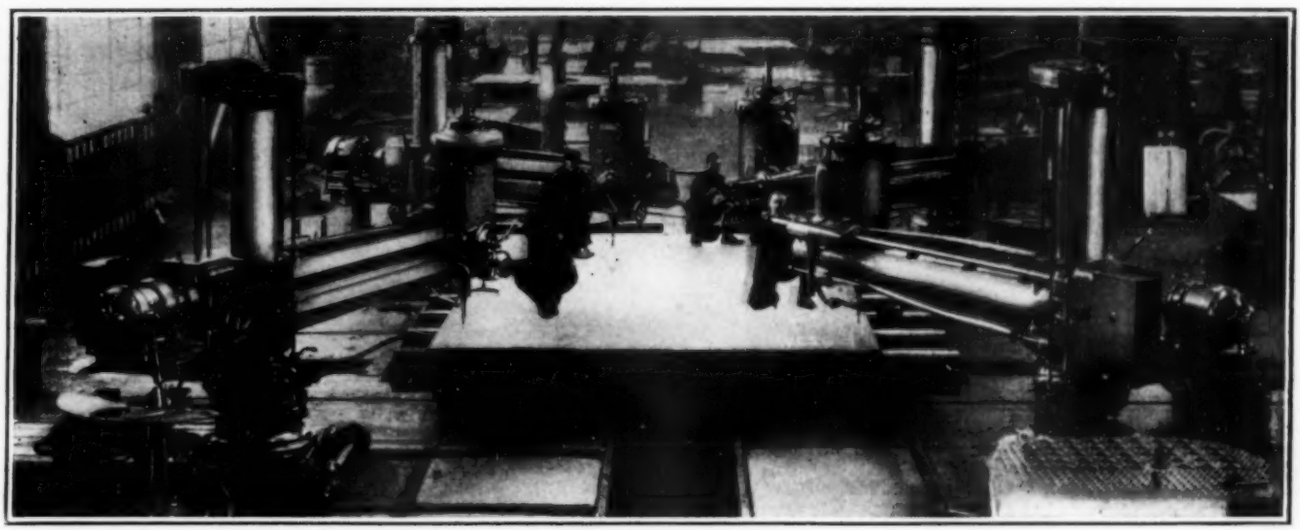
The method shown herewith prevents the piston from being distorted beyond its elastic limit as the burnishing



Double fixture for burnishing piston pin holes

broach is forced through the piston boss holes. The piston is a snug fit in the fixture, which is split at the top and holds the piston firmly by means of the clamping screw at the top. With the piston held firmly in this type of fixture, the broach leaves the piston true and round.

The double fixture enables the operator to load one side while the piston in the other is being burnished. This fixture is used in the Reo motor car plant.



A group of radial drilling machines for boiler plate work

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

The Danger of the Twenty Year Idea

IN A TABLE entitled "Economical Life of Machinery" just issued in a British yearbook, we find the useful life of machine tools listed at twenty years. This statement, unfortunately, is significant of the attitude of many machine users in this country as well as in Great Britain, and is responsible for much economic waste.

What is really meant is that the physical life of a machine may be twenty years, although even this is doubtful in high-production shops. It is safe to say that there are few cases where the true economic life is half twenty years, in shops where production costs are a real factor.

The economic life of a machine tool, or any other production unit, cannot be measured either by time or by its physical condition. The economic life of a machine ends whenever another machine or method has made it possible to produce parts at a lower net cost, regardless of the age of the machine or its physical condition. There is a case on record where the economic life of a batch of new machines expired before they had ever been put into service. New machines and methods made it conomical to scrap these machines before they ever produced a part.

The twenty-year idea is responsible for much of the depression and bad business in some industries. The idea that "the machines are good for another year" has kept many a concern on the wrong side of the business ledger.

Forget the age of a machine or its physical condition. Think only of how the cost of its product compares with that of the best machine available. That, and that alone, determines the economic life of any machine equipment.

Aerial Signposts Needed

COLONEL Lindbergh stated, after his tour of the country last year, that one of the most worthwhile steps which can be taken for the advancement of commercial aviation is the identification of towns and cities. Many other pilots have emphatically endorsed this statement, and a campaign has been started for painting or marking the name of each town on a properly located roof. Postmasters in towns with a population between 1,000 and 50,000 are to take the initiative in seeing that their communities are identified.

Any firm with an available roof in an unmarked town is urged to get in touch with its postmaster, or with The Daniel Guggenheim Fund for the Promotion of Aeronautics at 598 Madison Avenue, New York City, for information on recommended size and color of letters. Entirely aside from the obvious advertising advantages resulting from a firm's factory roof serving as the identification for its town, there will be direct advantages to business as a whole, since it is business which will benefit from a commercial air transportation system. Already some plants are finding it possible to carry smaller inventories because of the use of air mail service in an emergency.

The metal-working industry is well represented in nearly every community, and its members will be quick to see the advantages of taking the lead in this identification program by placing aerial signposts on their factory roofs.

New Metric Bill Threatened

AN ANNOUNCEMENT at the annual meeting of the Metric Association, held recently at Columbia University, states that Representative Fred A. Britten of Illinois will soon introduce a bill designed to put the metric system into effect in this country. Dr. Arthur E. Kennelly is quoted as saying that we are "persistently hanging behind" other civilized countries which would "bring pressure to bear on us, refusing to buy goods not produced in metric sizes."

In view of the fact that there is no law against using the metric system, that its use has always been possible by those desiring to do so, the adherence to English measuring units would seem to have some reason beyond a desire to "persistently hang behind" other civilized countries. And if we assume that Great Britain is as uncivilized as ourselves, we are in good company. Oddly enough these backward countries produce an overwhelming percentage of the world's machinery.

If, and when, the advanced countries who now use the metric system refuse to buy products made in other units, American and British manufacturers will undoubtedly adopt the metric system, even though it be less convenient and more costly in their products. But if the metric advocates are so sure of this pressure being brought to bear, what in the necessity of adopting such a measure?

Kingsbury Multi-Spindle Drilling and Tapping Machine with No. 119 Automatic Indexing Fixture

TO SUIT the customer's requirements, the standard drilling and tapping heads of the Kingsbury Machine Company, Keene, N. H., can be grouped about the No. 119 automatic indexing fixture to form automatic drilling and tapping machines capable of performing such operations as drilling, tapping, counterboring, facing, and milling. Pieces can be handled that have one hole or several at various angles to each other. Moreover, multi-spindle auxiliary drilling heads can be used.

The drilling heads can be mounted in horizontal or vertical positions or at any angle in between. These heads have capacity for $\frac{3}{8}$-in. drills, and have built-in motors and automatic feed. The heads and the indexing mechanism are synchronized by means of air trips. The machine does not run on a predetermined cycle, but adjusts itself automatically to the work. It can be arranged for full automatic operation, or a control valve, which the operator trips for each cycle, can be fitted. The machine is capable of 1,800 cycles per hour.

Examples of the wide divergence possible in set-up, which can be made to suit the work in hand, are illustrated in Figs. 1 and 2, respectively. Drilling, counterboring and tapping steel wedge nuts are performed on the machine shown in Fig. 1, and the vertical head is equipped with a milling attachment to mill the teeth in the sides of the nut. On this particular job, the machine produces six finished pieces per min., production being limited by the milling operation.

The other extreme in set-up is shown in Fig 2, the machine being designed for the drilling and countersinking of the crosshole in the head of a capscrew. In this machine, the indexing mechanism is situated in the base. At the right of Fig. 2 can be seen the automatic burring spindle unit, which can be used for underneath countersinking or other light operations.

The circular tables or beds on which these heads rest are furnished in two sizes, namely 52 and 72 in. in diam. Openings are provided around the center to permit chips to drop through into a pan in the cabinet base, whence they can be removed easily through a door at the rear. As for the indexing fixture itself, it is 12 in. in diam. The work dial or table is secured to the top of a vertical shaft mounted on Timken roller bearings. Geneva wheels are placed inside the base for indexing the table. A plunger, also mounted within the frame, engages with bushings to locate the table accurately after indexing. This plunger is controlled automatically.

The fixture is driven by a gearbox driven in turn by a $\frac{1}{2}$-hp. motor through a cone clutch and worm gearing. The table for the fixture can be supplied with either six or eight stations, as the buyer wishes.

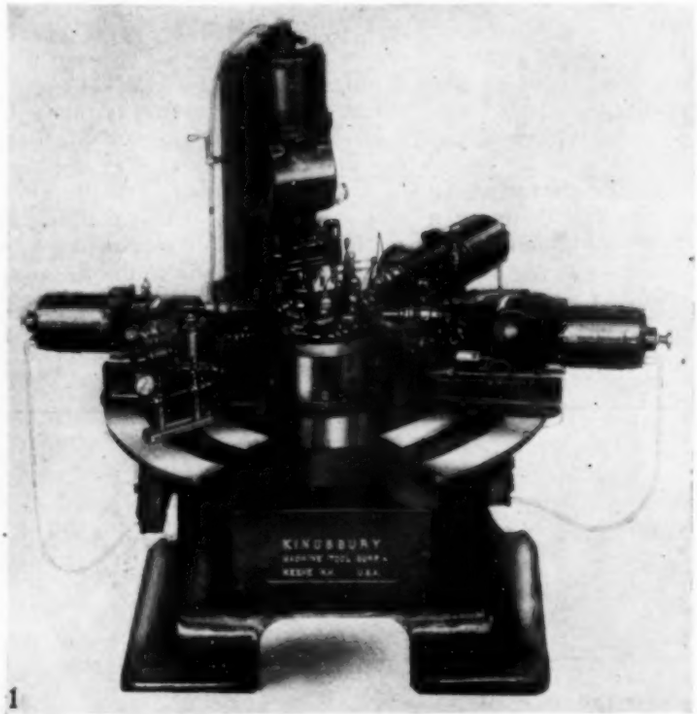


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Fig. 1 — Kingsbury Multiple-Spindle Drilling and Tapping Machine composed of standard drillheads arranged about a No. 119 Automatic Indexing Fixture for the drilling, counterboring, and tapping of steel wedge nuts.

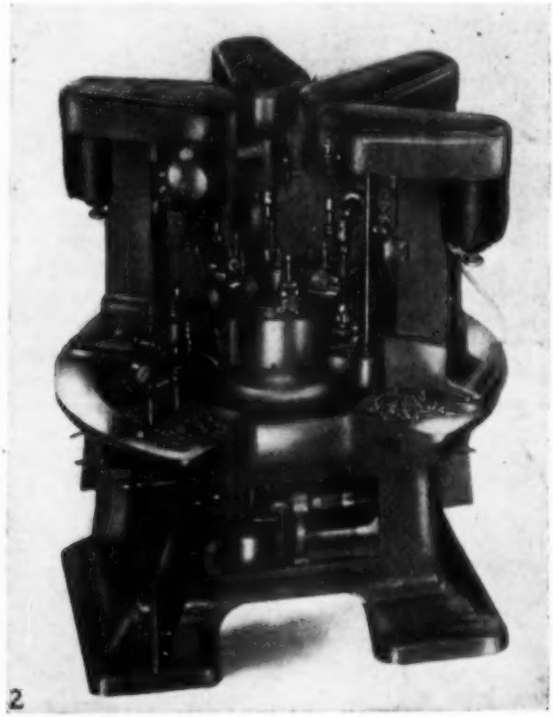

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Fig. 2—Another set-up with the spindles placed vertically for drilling and countersinking cross-holes in capscrews

Jones & Lamson "Hartometer" Thread Gage

A NEW step in thread gaging is claimed for the "Hartometer" screw-thread gage of which front and rear views are shown in Fig. 1. The device is being placed on the market by the Jones & Lamson Machine Company, Springfield, Vt. The outstanding advantages of the gage are: Completeness in one simple unit, eliminating the need for separate "go" and "no-go" gages and the ability to make rapid, accurate measurements of both the lead and the pitch diameter of threads.

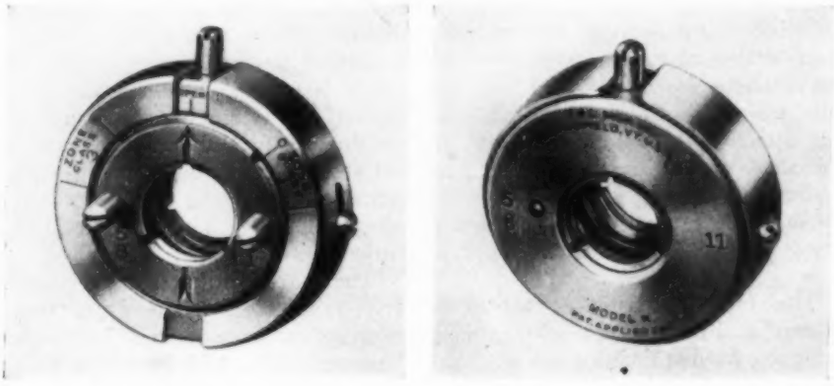


Fig. 1—Front and rear views of the Jones & Lamson "Hartometer" Thread Gage

The principle of the gage is that of two nuts meeting together on a screw with a definite means of measuring the angle of contact of matched points on the faces of the nuts. If the lead and pitch diameter of the thread of the screw mate exactly with the threads of the nuts the predetermined points will coincide, but if either the lead or the pitch diameter of the screw is off, the matching points will fall short or over a definite amount in proportion to the error.

The thread gage now being offered emphasizes the importance of correct lead on the thread to be gaged. It is claimed that the ordinary "go" and "no-go" thread gage does not show the actual point of error of the thread, so that an error in lead gives only the effect of a large, or "tight," thread. In such cases, where the lead of the screw is either too long or too short, the screw is actually reduced in shear strength of thread to only one thread, resulting in possible failure by the tearing of the threads one at a time. This lead, moreover, in order to distribute the load equally on all of the threads, should be correct within the tolerance when the nut is under a light stress. This condition is attained by the arrangement of the ring nuts in the Hartometer thread gage.

In Fig. 2 is shown a cross-section of the gage. The movement of the inner ring nut is controlled by an external thread, which is of finer lead and made accurately in relation to the internal thread that receives the screws to be tested. The inner ring nut is turned by means of the two pins, and, when it is brought to the position where the pointer coincides with the "open" line on the outer ring nut, the inner thread of both members is in a common or continuous helix. The inner thread is sufficiently large to allow the screw being measured to enter freely. The adjoining faces of the two nuts, when in the open position, are spaced to allow sufficient travel for gaging action.

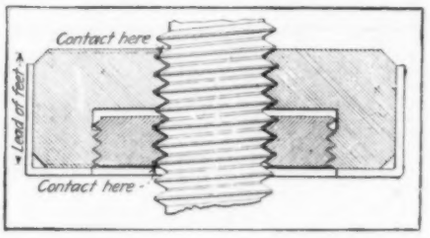


Fig. 2—Cross-section of the "Hartometer" Thread Gage

The gage is set with a standard screw plug to obtain the zero or "base" line on the dial plates. The gage may be checked and adjusted to a standard plug at any time, and adjustments are made by shifting the dial plates, which are held by the screws at the sides. The gage may then be sealed with wax. The gage is made regularly in sizes from $\frac{3}{8}$ to $\frac{3}{4}$-in. National Commission Standard fine and coarse series. The thickness of each gage is equal to the thickness of a standard nut of that size, so that the lead is therefore measured over a length corresponding to the length of engagement of the screw in service.

In Fig. 3 are illustrated four positions of the indicator in measuring

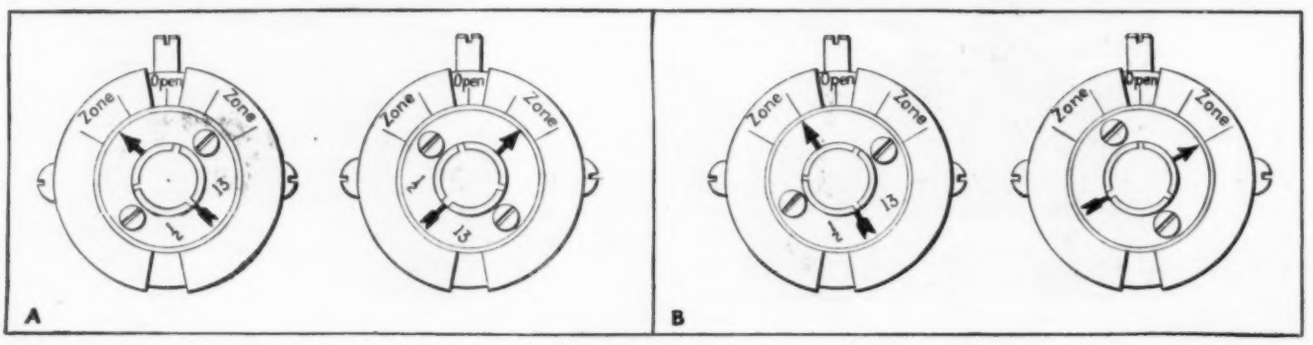


Fig. 3—Typical readings of the gage. In both A and B, the pitch diameter lies in the midtolerance, but in A the lead is correct, whereas in B it is long. Both threads are acceptable, however, being within the tolerance

screws. The "zone" is marked off to include the permissible variation within the allowable limits of the class of screw that is being inspected. Readings are taken on both sides of the open position in order to check for lead error. On a screw of correct lead, the travel to the right and to the left will be equal. A screw on which the indicator has a greater travel to the right than to the left has a longer lead than the standard. A screw on which the indicator has a greater travel to the left has a short lead. Indicator readings outside of the tolerance zone on either side of the open position show that the lead error plus the pitch diameter error more than equals the allowable tolerance.

Three-fluted taps, which are difficult to gage ordinarily, may be checked easily on this gage. The dial plates furnished are graduated with limits corresponding to standard class tolerances, but they may also be obtained with graduations showing the percentage of basic thread, which in turn corresponds to the percentages of shearing strength.

Peerless Universal No. 2 Portable Pipe Threading Machine

PIPE in sizes from ¼ to 2 in. can be cut off, chamfered and threaded on this universal No. 2 portable pipe threading machine, which has been placed on the market by the Peerless Machine Company, Racine, Wis. In Fig. 1 is shown a side view, while in Fig. 2 the operation of cutting off the pipe after threading is shown. The machine uses any kind of square, solid dies or hand stocks. Its weight is only 200 lb. so that two workmen can carry it to the job. The motor operates direct from the light socket.

In addition to threading pipe, bolts from ¼ to 1 in. can be handled, and the machine will also drive geared ratchet stocks for cutting pipe from 2½ to 6 in. in diam. The shortest piece of pipe that can be cut is 5 in. and the shortest piece than can be threaded is 4 in. The machine is driven by a ½-hp., universal, variable-speed motor of the reversible type operating on 115-volt d.c. or 110-volt a.c. circuits of 25 or 60 cycles. Because of the reversible feature either right- or left-hand threads can be cut.

The length of the machine is 29 in., its width is 19 in., and the height is 21 in. Shafts for driving geared stocks and portable stands are extra equipment.

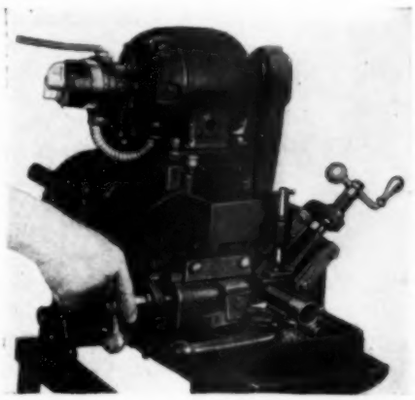


Fig. 2—View showing the cutting-off operation

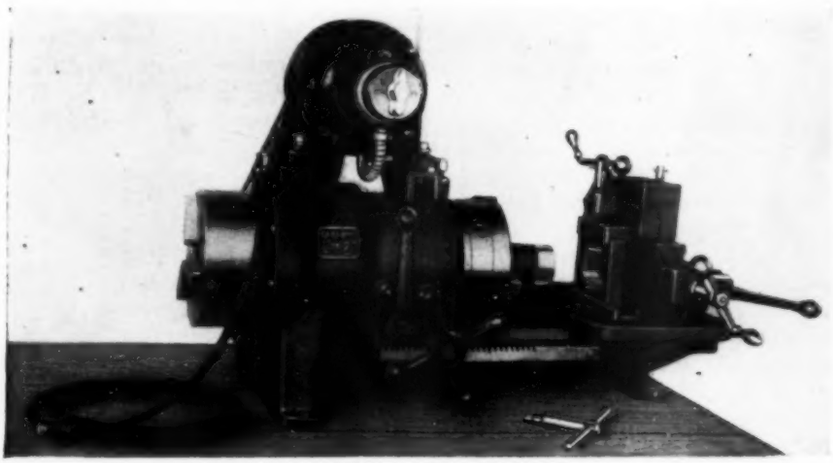
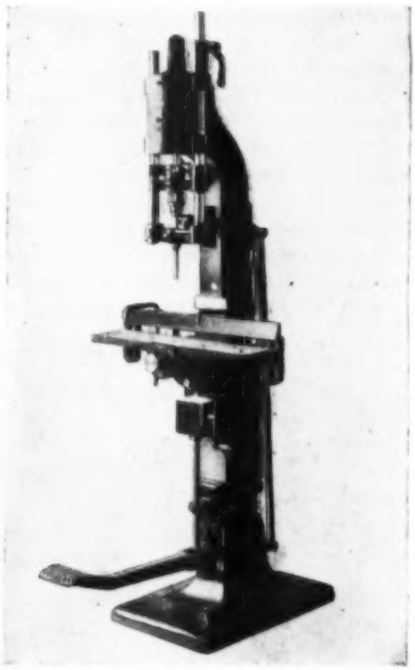


Fig. 1—Peerless Universal No. 2 Portable Pipe Threading Machine

Edwards Ball-Bearing Mortiser

CHISELS up to ¾ in. square and boring bits up to 1¼ in. in diam. can be carried in the Almond chuck of this mortiser, which has been developed by A. V. Edwards, 16 Broad Terrace, Bloomfield, N. J. The spindle of the machine illustrated runs at 3,600 r.p.m., and is driven by a ¾ hp. motor mounted directly on it at the top of the machine. The spindle is mounted on SKF ball bearings. The bit has a travel of 4 in., and the work table may be raised or lowered by a quick-acting handwheel through a distance of 15 in. A depth stop is supplied, and also means for adjusting the length of the bit in relation to the chisel.



Edwards Ball-Bearing Mortiser

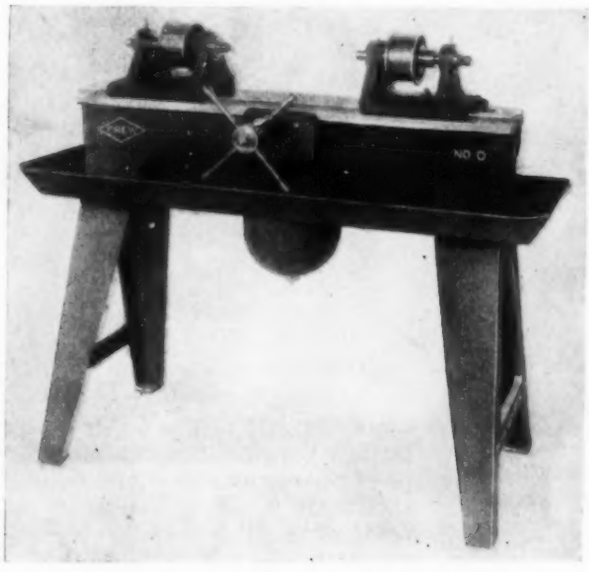
When operating, the work remains stationary and the chisel and bit are moved down into the work by means of the treadle. A screw clamp is supplied for holding the work. The table is 6x24 in., and is equipped with stops. The travel is 6 in. each side of the center by means of a rack and pinion and handwheel. The table also

has a screw adjustment of 4 in. in and out, and may be tilted through an angle of 45 deg. either side. Cross-slides and ways are made of iron, carefully machined and gibbed. A plain table may be supplied, when so desired. It is understood that the machine has been patented.

Frew No. 0 Duplex Horizontal Drilling Machine

DRILLING, counterboring, turning, hollow milling, and facing can be done in this No. 0 duplex horizontal drill, which has been placed on the market by the Frew Machine Company, 124 West Venango St., Philadelphia, Pa. The machine is designed for performing these operations from opposite directions on the same axis, the work being held in a suitable fixture mounted on the bed. Several types of fixtures can be used, and they may be operated by either a hand air-clamp or spring-type treadle.

The bed is a heavy, one-piece casting machined along the top and sides, the heads beng fitted to the bed on a dovetail having an adjustable gib take-up. Underneath the bed is an oil pan to catch the chips, and there is also an oil pot, which can be arranged for an oil pump and piping. The head spindles in the standard machine are carried in Timken tapered roller bearings, but can be provided with ball bearings at the option of the customer. Stops are provided for regulation of the depth to which the tools are permitted to go. Felt wipers are placed on the heads for clearing the chips away from the face of the bed.



Frew No. 0 Duplex Horizontal Drilling Machine

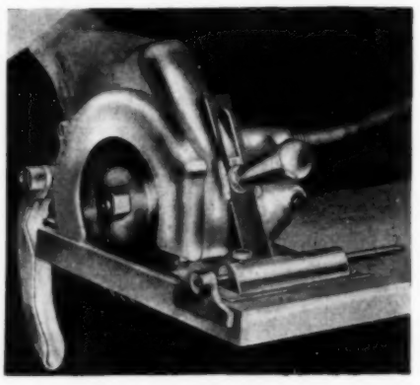
The usual method for providing motion to the head is by the use of a hand screw feed, the operator simply turning the capstan wheel on the front of the machine, thus drawing the heads together. This motion is obtained by means of bevel gears and by a leadscrew. Each head has an adjustable bronze nut, which connects with this lead screw, and these nuts can be unclamped and the heads adjusted to the desired distance from the work or in relation to each other.

Another method of providing motion to the heads is by means of individual lever feeds. In this construction the operator moves the heads to and from the work by means of levers, which produce a sensitive and quick means of throwing back the heads to clear the chips. The lever fulcrum is adjustable along the rear of the bed, thus permitting the levers to be placed in the most advantageous position for the operator. The screw feed type can also be furnished with power feed if desired, but because of the relatively small capacity of this machine, the hand screw feed is usually the most advantageous. The machine can also be furnished with individual motor drive to each head.

The largest hole that can be drilled in cast iron is $\frac{9}{16}$ in. and the swing over the bed is 9 in. The maximum and minimum distances between the spindle ends are $23\frac{1}{2}$ and 2 in., respectively. The taper holes in the spindles are No. 1 Morse. The length of feed for each head is $10\frac{3}{4}$ in. Floor space required is 48x24 in., and the weight is 800 pounds.

Porter-Cable Portable Saw

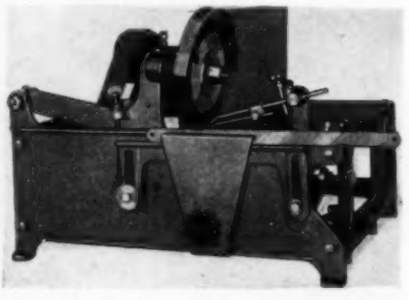
The pattern shop, the shipping room, and the plant carpenter were considered by the Porter-Cable Machine Company, Syracuse, N. Y., in designing this portable, power-driven circular saw. The saw is 6 in. in diam., and is mounted directly on the armature shaft, which runs in precision ball bearings, packed in grease. It will cut up $1\frac{3}{8}$-in. lumber, but weighs only $10\frac{3}{4}$ lb., and is operated easily with one hand. A gage is provided and also a depth adjustment for the saw when used in cutting dados or slots or removing flooring. In the case of double flooring, the saw can be set to cut through only the upper or finish floor. The guard protects the saw and the operator when not in use.



Porter-Cable Portable Saw

Foley Model G-109 Automatic Metal-Cutting Saw Grinder

The Model G-109 grinder shown is made by the Foley Saw Tool Company, Inc., 9 Main St., N. E., Minneapolis, Minn., for automatically



Foley Model G-109 Automatic Metal-Cutting Saw Grinder

sharpening hacksaw and circular saw blades as well as circular saws up to 8 in. in diameter. Adjustments permit automatic spacing for teeth from 14 per in. to $\frac{5}{8}$-in. spacing. The automatic spacing not only sharpens the teeth, but gives them all the same cutting angle and spacing, insuring equal work from each tooth. The average blade can be ground four to five times, if not allowed to become too dull before sharpening.

Cook Automatic Bolt and Nut Assembling Machine

TO MEET the demand for the delivery of bolts completely assembled with nuts, the automatic bolt assembling machine illustrated has been developed by the Asa S. Cook Company, Hartford, Conn. Two sizes are offered, one handling bolts up to $\frac{1}{4}$ in. in diam. by 3 in. long, and the other unit taking bolts up to $\frac{1}{2}$ in. in diam. by 6 in. long. The quoted production is 60 assembled bolts per minute.

In operation the screws are fed from one hopper down a gravity way, from which they are picked by a finger operated by a cam on the camshaft at the rear of the machine. The screw is brought down horizontally by the finger and fed into the spring chuck, which in turn is opened and closed at the proper time by cam motion. The hopper for feeding the screws is the center blade type. It is shown at the front. The nuts are fed from a standard "National" hopper and are carried into a horizontal feeding finger, which advances and permits the nut to screw onto the bolt. The nut is held firmly, while the bolt revolves with the chuck.

The assembled bolt is thrown into a chute by a finger that presses against the nut. If for any reason, such as bad threads, the nut does not screw on the bolt, it does not enter the chute, but is dropped directly down into the pan of the machine. Likewise, in case of a bad thread on the bolt, the latter is separated automatically from the assembled bolts. No jamming of the machine can occur, because of the automatic separation, and no unfinished bolts can enter the boxes with the completed work. In case a long screw enters the gravity incline, it will stop the passage of other bolts from the hopper, and can be seen at once and removed by the attendant. Short bolts will drop into the pan of the machine automatically. One operator can run from four to six machines. The cast-iron bases are planed on the ends, and arranged so that the machines can be bolted end for end and operated from one drive shaft with motor.

In changing from one size of bolt to another, cam changes are made easily by specially designed cams that can be detached without removing the shaft. All cams are triple so that three complete assembling actions are obtained at each revolution of the camshaft, thus cutting down the necessary rotating speeds at high production. Speed changes are made by changing the gears on the end of the shafts. Extra planed surfaces and bolt holes are provided for repositioning the hoppers, when changing the length of the bolts being assembled.

"Rego Leader" Oxy-Acetylene Welding Outfit

Designed for operation under severe conditions, this "Rego Leader" oxy-acetylene welding outfit has been placed on the market by the Bastian-Blessing Company, 240 East Ontario

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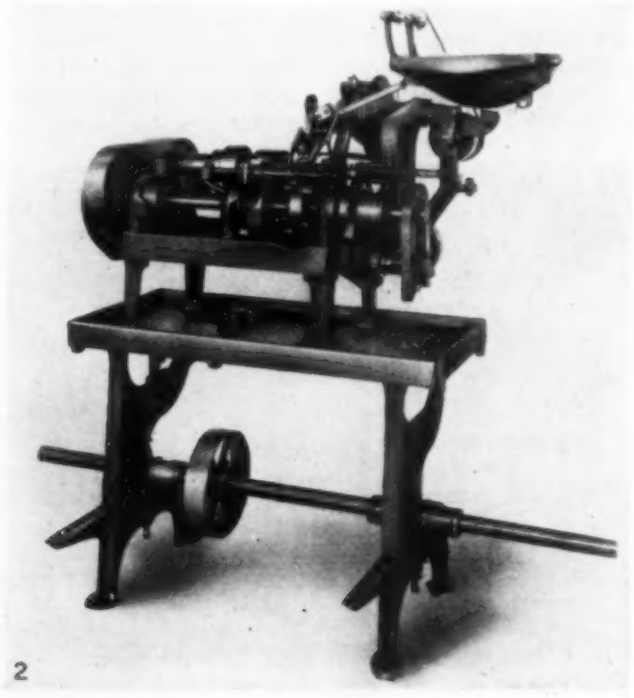
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Fig. 1—Front view of the smaller Cook Automatic Bolt and Nut Assembling Machine.
Fig. 2—Rear view showing the arrangement of the cams

St., Chicago, Ill. The standard outfit includes two regulators, one for oxygen and the other for acetylene. Each regulator is equipped with two gages. The regulators are made of forgings throughout.

The other equipment includes three type GMP pure copper welding tips and torch, two 12½-ft. lengths of ¼-in., D.F., corrugated, woven, high-pressure hose, a torch wrench and a regulator wrench. Extra equipment includes a GME 12-in. mixer and GMP tips Nos. 33 and 29, which can be used to increase the range of work done with the GM torch.

General Electric Vitreous-Enameling Furnace

A NEW type of continuous conveyor furnace, designed for vitreous-enameling service and marketed by the General Electric Company, Schenectady, N. Y., utilizes electric heat, and is economical in operation. The economies claimed are the result of two important features of design: The utilization of the so-called closed-end construction, and the elevation of the heated portion of the furnace.

In the closed-end type of construction, the furnace is built in the shape of a U. The work enters and leaves by the same end, and the heating units are installed at the closed end. Thus the heat is concentrated in the latter part of the furnace, the remainder of the furnace being utilized as a heat interchange chamber. In other words, the incoming cold work is dried and preheated in this neutral portion by the outgoing heated work.

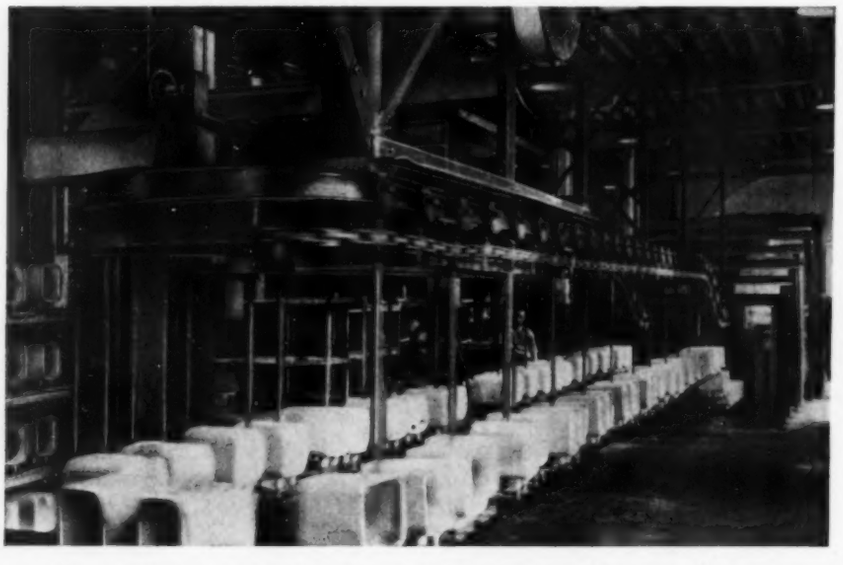
The other improved construction feature is the elevation of the heated zone above the level of the remainder of the furnace, thus trapping the heated air in the closed end of the furnace, and eliminating convection losses.

A total of eight furnaces have so far been given successful trial, three more being in course of erection. Among the applications made are the manufacture of electric ranges, electric refrigerators, lighting reflectors and miscellaneous cast-iron parts. Substantial reductions in overall enameling costs have been realized as the result of the existing installations, and a decided improvement in quality has been secured. It is predicted by the manufacturer that this type of furnace will also be of value in the manufacture of kitchen or hollow ware.

The furnace is simple to operate. The heating circuits are divided into several zones, each with an automatic temperature control. This construction makes it possible to secure uniform temperature from the top to the bottom of the charge, and to obtain any desired heating curve. The speed of the conveyor and temperature of the furnace can be changed readily to accommodate different classes of work.

These furnaces can be arranged in a group of three, one for the ground coat and the other two for the finish coats, the ware being taken from one conveyor and dipped and placed on the next conveyor. This reduces the handling required and gives a large output per unit of floor space and per operator.

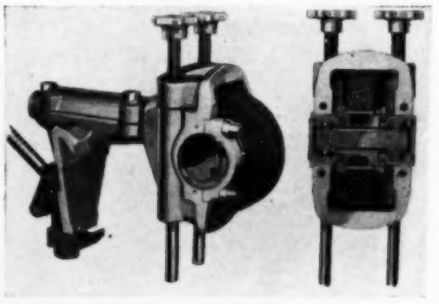
The furnaces are available in several standard sizes, ranging in output from 1,000 to 8,000 lb. of ware per hour. The General Electric Company has also announced that it is ready to market a number of sizes of the box type of periodic electric furnaces for the same class of service.



General Electric Inclined U-Type Electric Conveyor Furnace, 28 ft. long, engaged in vitreous-enameling refrigerator evaporators

Ross Emery-Wheel Truing Tool for Cylindrical Grinding Machine

Greatly increased bearing life and high operating accuracy are claimed for this improved dresser for cylindrical grinding machines, introduced recently by the Ross Manufacturing Company, Cleveland, Ohio. The hub design of the tool is a departure from previous ball-bearing types in that the inner, instead of the outer, bearing races revolve, thus attaining a 40 per cent decrease in ball speed, a construction that adds materially to the life of the bearings. Larger balls and "precision" machine tool bearings mounted in hardened and ground steel cartridges are said to give 60 per cent more load-carrying capacity.



Views of the Ross Emery-Wheel Truing Tool for cylindrical grinding machines

Bearings are of the closed type, thus avoiding initial loads and the necessity for later adjustment by the operator. One bearing is fixed, while

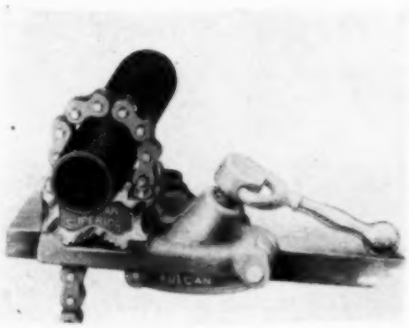
the other floats. By mounting the bearings outside the hub and using a "live" shaft, the distance between the bearing centers has been doubled, in order to reduce the leverage produced by axial thrust loads of the grinding wheel against the dressing wheel, and to prevent "rocking" of the dresser wheel while in operation. The hub axle is made in one piece to gain freedom from vibration and distortion under load.

Four washers, two of felt and two of specially-treated cork, are employed to seal the bearings against grit and water. The edges of the grooved circumferences of the cork rings flex and form an air gap and oil seal with the hub.

A feature emphasized by the manufacturers is that dressing wheels may be replaced without disturbing the bearing assembly of the tool, since the wheel mounting and bearing assembly are integral. This is done quickly by removing four socket-head capscrews that secure the two bearing caps. The tool has two adjustable steadyrests, giving three-point support and enabling tilting to any desired shearing angle. To gain light weight, the holder and bracket of the tool are of "Lynite."

"Vulcan Superior" Chain Pipe Vise

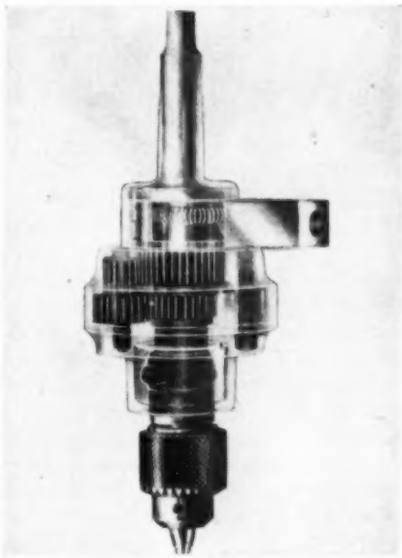
The "Vulcan Superior" chain pipe vise illustrated has been placed on the market recently by J. H. Williams &. Co., Buffalo, N. Y. Two advantages claimed are that the handle of the vise is placed on top, where it is easy to operate, and the reversible jaws insure longer life, because they can be reversed by simply unscrewing the bolts when the teeth become worn. No castings are used in the vise, the parts being of drop-forged steel. The chain is the same as used in the Vulcan chain pipe tongs. It is unbreakable, compact, rapid, and positive in grip. The device is nicely finished with rust-proof chromium plating, and is furnished in two sizes for $\frac{1}{8}$- to $2\frac{1}{2}$- and $\frac{1}{4}$- to $4\frac{1}{2}$-in. pipe, respectively.



"Vulcan Superior" Chain Pipe Vise

"Midget" Tapping Device

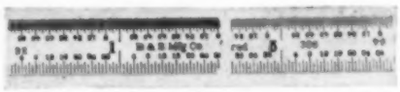
The elimination of broken taps and stripped or distorted threads is claimed by the Chas. L. Jarvis Company, Gildersleeve, Conn., when the "Midget" tapping device is used. A phantom view is shown in the illustration. The device may be used on any drilling machine. The features include ball bearings, a friction reverse and a friction drive. Holes up to $\frac{3}{16}$ in. can be tapped in steel and up to $\frac{1}{4}$ in. in cast iron. The operating speed is 2,500 r.p.m. Size overall is $4\frac{3}{4}$ in. and the diameter is $2\frac{1}{4}$ in. The weight is less than 3 pounds.



Phantom view of the "Midget" Tapping Device

Brown & Sharpe Improved No. 306 Flexible Steel Rule

Figured graduations are now placed on both corners of one side of the No. 306 6-in. flexible steel rule, manufactured by the Brown & Sharpe Manufacturing Company, Providence, R. I. This feature will make for easier reading of certain classes of work. The 32nds are numbered every fourth graduation and the 64ths every eighth graduation. Thus this rule has two features: figured graduations and flexibility.



Brown & Sharpe Improved No. 306 Flexible Steel Rule

Craley Improved 14x20-Inch "Master Toolmaker" for Drilling Jigs

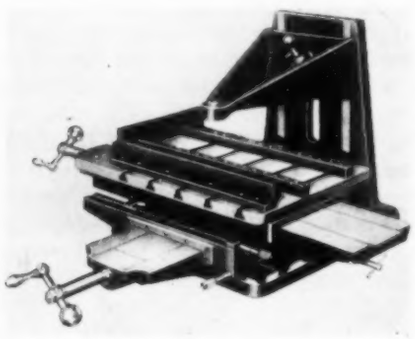
An improved model of larger size of the "Master Toolmaker" for locating and drilling holes in jigs, dies, masterplates, and templets, has been announced by the C. C. Craley Manufacturing Company, Box 192, Shillington, Pa. This improved size is approximately twice as large as the previous model, the worktable having an area of 14x20 in., with longitudinal movement of 18 in., transverse movement of 12 in., and vertical movement made to suit the purchaser.

The Master Toolmaker may be used on a drill press much like an ordinary jig. The work is clamped against the guide strips, which are held in position by screws and dowel pins so that one or both may be removed for special work or oversize jobs. As shown in the illustration, two adjustable parallel strips are provided. They are positioned on the worktable to suit different sizes and shapes of the dies that are to be bored, and may be clamped to the worktable by means of socket-head cap screws and nuts that slide in the $\frac{1}{2}$-in. T-slots of the worktable. Tapped holes are provided in the parallel bars for use in clamping work. The guide strips previously mentioned form a right angle and also the base line or zero point from which all locations are determined. The tool is arranged so that the micrometers both read zero against the stops when the center of the bushing supporting arm is located at the inner edges of these guide strips. This construction makes it possible to machine any number of holes without laying them out.

The desired locations are obtained by adjusting the worktable with the left hand and the micrometer with

the right. If the location is more than 1 in. from the guide strip, the desired standard or distance bar is placed in the V-bearing between the stop and micrometers. Special starting drills are furnished so as to have the holes started central with the bushings. Special reamers are also furnished having only one cutting lip, and they act much like a boring tool in finishing the holes to size. Both micrometers are arranged in front for the convenience of the operator.

Between the anvil of the lower micrometer and the back stop, a spacing bar is placed, and is held in position against the micrometer anvil by



Craley Improved 14x20-Inch "Master Toolmaker" for Drilling Jigs

the tension of a light spring. The standards or distance bars are laid in the V-shaped seat between the spacing bar and the back stop. The micrometer heads, of the depth-gage type are of Brown & Sharpe manufacture. Distance bars are of tool steel, hardened, ground and lapped on the ends. Gage blocks may be used in place of micrometers and distance bars.

The back or upright member is fastened to the base by screws and taper dowel pins so that it may be removed, when using the tool on the milling machine for boring holes of various sizes or when accurate milling operations are desired. The full-length gibs are of cast iron, and are fitted with a patented arrangement that keeps the gibs under the desired tension at all times, thus preventing any dust or dirt from getting in the bearings.

The arm or bushing support is provided with similar spring tension to prevent it from dropping when the clamp is loosened for adjusting to the work. The arm is of box construction, and is held in position on V-bearings. The arm is fitted with hardened and lapped bushings to receive the slip bushings for different size holes. The bushings are held in position by set screws. On this model, two arms, which are interchangeable, are provided. One carries bushings from $\frac{3}{16}$ to $\frac{5}{8}$ in. in diam. and the other will take bushings from $\frac{5}{8}$ to 1 in. in diam., and is also equipped with a 1-in. deep hole to support the boring bar, when larger holes are desired. The weight of the Master Toolmaker is 400 lb. net.

"Enduro" KA2 Stainless Steel

License rights to manufacture improved stainless steels under Krupp Nirosta patents, and under the supervisory direction of Prof. Doctor Benno Strauss, who discovered the alloys, have been obtained from Fried. Krupp, A. G., Germany, by the following companies: Central Alloy Steel Corporation, Massillon, Ohio; Ludlum Steel Company, Watervliet, N. Y., and the Babcock & Wilcox Tube Company, 85 Liberty St., New York, N. Y. These three licensees have organized for joint research and promotion of this improved stainless product. The offering at this time is the "Enduro" KA2 steel, a material that is said to be resistant to air, water, dilute solutions and acids at high temperatures and at high pressures. It can be deep drawn, wire drawn, machined readily, and welded by electricity or gas. Further, it can be polished to a mirror-like surface, is non-magnetic, and has approximately the ductility of copper. The steel is now available in all standard forms from the above manufacturers. It is stated by the manufacturers that the addition of nickel greatly increases the corrosion resistance of the alloy, and provides complete immunity to many materials, which attack straight stainless steel.

Trade Publications

CARNEGIE BEAM SECTIONS. The Carnegie Steel Co., subsidiary of the U. S. Steel Corporation, Pittsburgh, Pa., has published the second edition for November 1, 1928, of its booklet entitled, "Carnegie Beam Sections," with additions to the new series. This book supersedes the one bearing the same title and published as the first edition under date of October 1, 1927. It gives the profiles, properties and safe loads for additions to the new series of structural steel beams and column sections. The straight-flange beams shown are valuable for built-up welded machine tools. The information is given in the form of tables, as usual. Several illustrations of different types of construction are given. The book contains 46, 7½x5-in. pages.

"MULT-AU-MATIC" METHOD. The Bullard Co., Bridgeport, Conn., has published for the plant executive a fine brochure on the "Mult-Au-Matic" method, or the uses and operations that can be done on the four- and six-spindle types of Mult-Au-Matic vertical lathes. Briefly, the machine comprises four or six independent turning units, operated automatically in combination on a series of identical pieces. A completely finished piece of work is produced in the time consumed by the longest single operation. Several types of heads are available and their uses are explained. The balance of the catalog is made up of descriptions and photographs of various operations and the times taken to perform them. The machines and the methods are primarily for the attainment of mass production. The catalog is bound in an art cover, and contains 75, 11x8½-in. pages.

REBUILT MACHINE TOOLS. The Simmons Machine Tool Corporation, 1205 Troy Road, Albany, N. Y., has published a catalog on its line of rebuilt machine tools. The catalog follows the usual method on listing the units, which are on hand, but it radically departs from old ideas in that the units shown can always be supplied. In other words, it pictures a standardized stock. Each machine is illustrated and carries a complete description with necessary specifications, cubical contents and weight for the information of the foreign buyer. The catalog contains 158, 12¼x9¼-in. pages.

SILVER SOLDERS. Messrs. Handy & Harman, 57 William St., New York, N. Y., have published a "Handy Book of Silver Solder" which treats of the proper selection and use of the material. The purpose of this book is to present the findings of a period of research into soldering requirements and how best to meet them. Silver solders have been developed and standardized to a point where they are being used with a new degree of certainty for soldering copper, brass, nickel, Monel metal, steel and the new stainless steels, or combinations of these metals. The characteristics of the various formulas are given, together with their particular uses. Bulletin No. 1, inclosed with the catalog, illustrates and describes the methods of making good joints.

News of the Week

Western Metal Congress and Exposition Marks Progress of Pacific Manufacturing

Many local and national societies discuss developments in metal-working industries

THE growing importance of the Pacific Coast region as a manufacturing center was strikingly borne out by the co-operative spirit shown in the first Western Metal Congress which was held in Los Angeles, Calif., Jan. 14 to 18. Held under the auspices of the American Society for Steel Treating, the congress was considered as one of the largest technical events ever held in the western states, attracting an attendance of approximately 45,000 from various industries throughout the West. Of this number, there were approximately 10,000 registered as executives and engineers.

In connection with the congress was held the Western States Metal and Machinery Exposition at the Shrine Civic Auditorium. More than 175 manufacturers and distributors of machinery, metals, heat-treating equipment, small tools and electrical units, exhibited equipment ranging from raw materials to finished products applicable to industries of the West.

The congress and exposition marked the launching of a technical service to the West Coast States such as has been rendered to the East for many years. From many indications it was conceded that the congress is an established institution, and tentative plans have been made to hold a similar event in January, 1931, with San Francisco as the selected city.

Various national and local societies and organizations participated in the technical program, thus representing many of the industries prominent on the Pacific Coast. The bodies co-operating were: American Foundrymen's Association; American Institute of Mining and Metallurgical Engineers; American Society of Mechanical Engineers; American Welding Society; California Division, American Petroleum Institute; Chamber of Mines and Oils; Institute of Metals; Institute of Marine Engineers; Metal Trades and Manufacturers Association; National Purchasing Agents Association; Pacific Coast Electrical Association; Pacific Coast Gas Association; and Society of Automotive Engineers.

Technical sessions were held in the mornings at the Biltmore Hotel, and afternoon sessions were held at the Auditorium. The papers presented, together with their authors, were as follows:

"The Importance of Shops in University Training," by Arthur B. Domonoske, executive head mechanical engineering department, Stanford University, Cal.; "Some Applications of Physical Test Data to Mechanical Design," by Prof. W. H. Clapp, department of metallurgy and machine design, California Institute of Technology, Pasadena, Calif.; "Heat-Treatment of Dies, Tools and Gears," by Jordan Korp, engineer of the Leeds & Northrup Co., Philadelphia, Pa.; "Relation of Heat-Treatment to Design," by R. T. Bayless, editor, *Abstracts*, A.S.S.T.; "Sand Testing Equipment and Demonstration," by A. A. Grubb, Mansfield, Ohio, member of A. F. A. Sand Testing Committee; "Nickel-Chrome Alloy Iron," by W. R. Shimer, metallurgical engineer, Bethlehem Steel Corporation, Bethlehem, Pa.; "Heat Treatment of Carbon and Alloy Steel Castings," by J. E. Donnellan, secretary recommended practice committee, of the A.S.S.T., Cleveland; "Furnaces," by R. E. Talley, president of the George J. Hagan Co., Pittsburgh, Pa.

Papers on Materials

"Metals and Alloys for Industrial Applications Requiring Extreme Stability," by Jerome Strauss, chief research metallurgist of the Vanadium Corporation of America, New York; "Valves and Fittings in the Oil Refinery, the Materials Used in Their Construction, Their Design, and Their Application in Particular Services, and High-Pressure Oil Conveying," by V. T. Malcolm, metallurgical engineer, Chapman Valve Co., Indian Orchard, Mass.; "Tendency Toward Higher Steam Pressures in Both Marine and Stationary Services," by Robert L. Daugherty, professor mechanical engineering, California Institute of Technology, Pasadena, Calif; "Heat, Refractories and Insulation," by Guy A. Barker, manager of the industrial department, Pacific division of Johns-Manville, Inc., San Francisco, Calif.; "Tool Joints," by W. H. Fisher, chief metallurgist and A. H. Martois, research department of the Emsco Derrick & Equipment Co., Los Angeles, Calif.; "Cast Steel Slush Pump Cylinders," by Lester Keim, general manager of the Oil Well Supply Co. of California, Los Angeles, Calif.; "Kellys, or Grief Stems," by Glenn C. Merkley, engineering department, National Supply Co. of California, Torrance, Calif.; "Sucker Rods," by W. H. Laury, research engineer, of the Axelson Machine Co., Los Angeles.

"Sucker Rod Strains and Stresses," by F. W. Lake, superintendent of operations, Orange County Division, of the Union Oil Co., Los Angeles; "Welding and High Pressure Gas Distribution," by C. J. Coberly, president of the Kobe, Inc., Los Angeles; "On the Double Diagram of the Iron-Carbon System," by Dr. Kotaro Honda, research institute for iron and steel, Imperial University, Sendai, Japan; "Proposed Metallurgical Control for Small Heat-Treating Plants," by Dr. Welton J. Crook, professor of metallurgy, Stanford University, Calif.; "Standard Complete Factory-Built, 25- to 50-Ton Flotation Mills," by J. P. Shimmin, chief engineer of the Southwestern Engineering Corporation, Los Angeles; "Heat-Treatment of Gears," by W. H. Phillips, vice-president, Molybdenum Corporation of America, Pittsburgh.

Papers on Industrial Heating

"Gas and Electricity as Heating Mediums," by F. W. Manker, vice-president, Surface Combustion Co., Toledo, Ohio; "Heat-Treating Furnace Design," by J. H. Gunz, industrial engineer, Pacific Gas & Electric Corporation, San Francisco; "Existing Heat-Treating Installations," by E. M. DeRemer, industrial engineer, Southern California Gas Co., Los Angeles; "What the Gas Companies are Doing for Industrial Heating," by C. M. Grow, new business manager of the Southern California Gas Co., Los Angeles; "Gas as Applied to Carburizing," by Robert G. Guthrie, metallurgist, Peoples Gas Light and Coke Co., Chicago, Ill.; Address, by Paul Downing, vice-president, Pacific Gas and Electric Corporation, and president of the Pacific Coast Electrical Association, San Francisco; "An Illustrated Symposium on Electric Heat as Applied to Industry," by Dr. Carl L. Ipsen, General Electric Co., Schenectady, N. Y.; "Electric Heat and Its Application to Heat-Treating," by T. C. Kelly, Westinghouse Electric & Manufacturing Co., Mansfield, Ohio.

"Manufacture and Heat-Treatment of Automobile Leaf Springs," by J. B. Rauen, general manager, U. S. Spring Co., Los Angeles; "Production of Nickel Steel Castings by Electric Furnace Method," by E. Favary, consulting engineer, Moreland Motor Truck Co., Burbank, Calif.; "Aluminum as Applied to the Automotive and Airplane Industry," by Dr. Zay Jeffries, chief research engineer of the Aluminum Co. of America, Cleveland, Ohio; "The Use of Metal in Aircraft Construction," by J. H. Kindelberger, chief engineer, Douglas Aircraft Co., Santa Monica, Calif.; "Metallurgical and Heat-Treat-

ing Problems in Motor Car Manufacture," by J. M. Watson, chief metallurgist, Hupp Motor Car Co., Detroit, Mich.; "The Welding of Steel Buildings and Bridges," by Dr. Frank P. McKibbin, consulting engineer of the General Electric Co., Schenectady, N. Y.; "Heat-Treatment with Oxy-Acetylene Flame," by J. J. Bruton, service engineer of the Oxweld Acetylene Co., New York, N. Y.; "Fabricating Large Size Rotating Machinery," by H. V. Putnam, power engineer, Westinghouse Electric & Manufacturing Co., Los Angeles.

An address of welcome was given by Wade W. Hampton, chairman of the local section of the A.S.S.T., and superintendent of the Hughes Tool Co., Los Angeles. A response was made by Dr. Zay Jeffries, president of the society.

Inasmuch as oil-well activities and oil refining make up one of the chief industries of the Coast States, several papers were devoted to problems pertinent to drilling, pumping and refining. Most of these topics were presented at two sessions set aside for the oil industry. Heat-treating, furnace design and operation, general manufacturing and maintenance practices constituted the other subjects discussed.

Among the exhibits were to be seen a variety of Pacific Coast products, some of which were displayed for the first time. This group, constituting about one-third of the display, was evidence of the manufacturing development taking place in the West. The products included machine tools, electric motors and appliances, heat-treating furnaces and equipment, small tools, sand blasting units, compressors, welding machines and equipment, pipe fittings, castings, oil-well machinery, material-handling appliances, and automotive and aeronautical tools. Many of the exhibitors had running displays such as machinery, furnaces, welding equipment and small tools.

Aircraft Products Exhibited

Several exhibits of aircraft products manufactured on the Pacific Coast were shown. These products attracted general attention due to the unusual public interest of aviation. The displays included complete planes, radial motors, metal and wooden wing and fuselage construction, propellers and accessories.

In connection with the exposition at the auditorium, a continuous moving picture show was given. The pictures consisted of 45 reels of film, donated by various exhibitors and illustrating machinery and tools in use, miscellaneous mechanical features and engineering developments. The show afforded a means of rest for visitors as well as the primary purpose of exhibiting actual operating conditions of different forms of equipment.

Two floors were used for the exhibits, the concerns represented being:

Abrasive Co.
Aelium Co.
Aeronautical World
Ahlberg Bearing Co. of California
Aircraft Holding Corporation
Air Reduction Sales Co.
Ajax Electrothermic Corporation
Alcorn Combustion Co.
American Brass Co.
American Car and Foundry Co.
American Foundrymen's Association
Armstrong-Blum Manufacturing Co.
Armstrong Brothers Tool Co.
Asquith and Son, F. A.
Atkins and Co., E. C.
Atlas Steel Corporation
Axelson Machine Co.

Baldwin Chain Co.
Bausch and Lomb Optical Co.
Bethlehem Steel Co.
Black and Decker Manufacturing Co.
Blackor Co.
Bliss Co., E. W.
Bignall and Keeler Machine Works
Botfield Refractories Co.
Bristol Co.
Brown Instrument Co.
Buffalo Forge Co.
Bureau of Power and Light (L.A.)

California Malleable Castings Co.
California Oil World
Calorac Electric Corporation
Campbell, Inc., A. C.
Cannedy-Otto Manufacturing Co.
Carborundum Co.
Central Alloy Steel Corporation
Chicago Steel and Wire Co.
Chiksan Oil Tool Co., Ltd.
Clark Tructractor Co.
Cleveland Twist Drill Co.
Clipper Belt Lacer Co.
Colonial Steel Co.
Cooper Hewitt Electric Co.
Crucible Steel Co. of America
Cushman Chuck Co.

Dalton Tool and Machine Co.
Dearborn Chemical Co.
Dings Magnetic Separator Co.
Disston & Sons, Inc., Henry
Ducommun Corporation

Eason and Therolf Tool Co.
Eastman Kodak Co.
Electric Steel and Manufacturing Co.
Electrical Refractories Co.
Elwell-Parker Electric Co.

Federal Aircraft Corporation
Federal Welder and Machine Co.
Firth-Sterling Steel Co.
Ford Co., J. B.
Fusion Welding Corporation

Gairing Tool Co.
Gathmann Engineering Co.
General Electric Co.
Globar Corporation
Goddard & Goddard Co.
Grant Manufacturing & Machine Co.

Hagan Furnace Co., George J.
Halcomb Steel Co.
Hardinge Stellite Co,
Hardinge Brothers
Haynes Stellite Co.
Heppenstall Forge and Knife Co.
Herberts Machine and Supply Co.
Hisey-Wolf Machine Co.
Horton and Son Co., Inc., E.
Houghton and Co., E. F.
Hughes Tool Co.

Jensen Instrument Co.
Johns-Manville Co.
Johnson Gear Co.
Jorgenson Co., Earle M.

Kay-Brunner Steel Casting Co.
Kelly Reamer Co.
Kinney Iron Works
Knapp Co., James H.
Krupp Nirosta Co., Inc.

L. A. Automotive Works
Laidlaw, William, Inc.
Landis Machine Co.
Largent Co.
Leeds and Northrup Co.
Leitz, Inc., E.
Lincoln Electric Co.
Linde Air Products Co.
Ludlum Steel Co.

MacClatchie Aeronautical Co.
Machinists Tool and Supply Co.
Masterson and Co., Jos. A.
McGill Metal Co.
McLanathan and Sons, F. W.
Merco Nordstrom Valve Co.
Merit Oil Equipment Co.
Mettler Co., L. B.
Meyers Machinery Co.
Minder Co., J. W.
Minerals and Metals Corporation
Morse Twist Drill and Machine Co.

National Twist Drill and Tool Co.
New Departure Manufacturing Co.
Niagara Machine and Tool Works
Norma-Hoffman Bearings Co.
Northwestern Manufacturing Co.
Nuttall Co., R. D.

Oakite Products, Inc.
Oil Age
O K Tool Co.
Oil Bulletin

Pacific Abrasive Supply Co.
Pacific Factory.
Pangborn Corporation
Peerless Machine Co.
Peir Company, A. H.
Pels and Co., Inc., Henry
Penton Publishing Co.
Perfect Caster Manufacturing Co.
Perin, Ira G.
Petroleum World
Plomb Tool Co.
Purox Co.

Reed Manufacturing Co.
Regan Forge & Engineering Co.
Remington-Rand Co.
Rhodes Manufacturing Co.
Rockford Machine and Tool Co.
Rotor Air Tool Co.

Savage, W. J., Co., Inc.
Sharpe Manufacturing Co.
Shrader Electric Co.
Sidney Machine and Tool Co.
Simonds Saw and Steel Co.
Slate Aircraft Corporation
Slepper and Hartley, Inc.
Smith Booth Usher Co.
Southern California Edison Co.
Southern California Gas Co.
Southern California Iron & Steel Co.
Spencer Turbine Co.
Spindler and Sauppe
Standard Oil Co.
Standard Tool Co.
Steel Publications
Sterling Electric Motors, Inc.
Stone Fog Light Co.
Stoody Co.
Story Co., C. S.
Strand and Co., N. A.

Timken Steel and Tube Co.
Timm Co., O. W.

Union Drawn Steel Co.
U. S. Electrical Manufacturing Co.

Vanadium Corporation of America
Vegetable Oil Products Co., Inc.
Vernon Foundries
Victor Welding Equipment Co.

Welding Engineer Publishing Co.
West Coast Pipe and Steel Co.
Western Air Express
Western College of Aeronautics
Western Drop Forge Co.
Western Machinery World
Westinghouse Electric & Manufacturing Co.
Whitman Barnes-Detroit Corporation
Whitney Manufacturing Co.
Wilcox Co., E. A.
Wilson-Maeulen Co.
Wilson Welder and Metals Co.
Wisconsin Electric Co., Inc.

Young Brothers Co.

Plant visitations were extended for those interested in seeing Pacific Coast factories and industries in operation. Among the trips scheduled were those to airplane factories and flying fields, steel plants, oil fields, railway shops and electric power plants.

Abstracts of some of the papers presented follow. Additional papers will be published in part in a later issue.

Heat-Treatment with the Oxy-Acetylene Flame

By J. J. Bruton
Service Engineer, Oxweld Acetylene Co.

Perhaps the most obvious use (as well as the most widespread) of the oxy-acetylene flame for heat-treating is for emergency hardening of small metal cutting tools, like lathe tools, milling cutters and drills. Every machine shop has facilities for hardening tools. But suppose it is necessary to prepare two or three in a hurry. The furnace or forge is cold, and takes time to bring to

heat. Instantly the oxy-acetylene flame is at full heat; the cutting edge of the tool may then be brought to temperature gradually by brushing the flame back and forth. At the correct time it is plunged into water. The job is done before the forge fire could be lighted.

Dies for drop forging, stamping or punching are usually formed of a good-sized piece of fine steel and then carefully hardened. It is frequently desirable to draw the temper of the under side, in order to toughen the block against the working shocks. The hardened die may be partly immersed face down in a little water, and the back brushed steadily with an oxy-acetylene flame until it has been properly tempered. Gradual and uniform heating is evidently necessary to avoid cracking the hard die.

Hardening of Malleable Iron

Malleable iron is seldom regarded as a metal susceptible of hardening. It resembles wrought iron in its softness and toughness. Furthermore, it is essentially different from steel, since it is an alloy of iron and free carbon. However, it is found that under the quick sharp heat of the oxy-acetylene flame, the particles of free carbon dissolve readily in the iron crystals, and a satisfactory hardening results from a quick quench. However, it is necessary that the heating be intense and very brief. Herein lies the advantage of the oxy-acetylene flame.

Materials Used in the Construction of Valves and Fittings

By V. T. Malcolm
Metallurgist, Chapman Valve Co.

It is almost impossible to exaggerate the importance of the place that alloys are taking in the industrial world. The day of special alloys has certainly arrived, and it behooves the engineer who would keep in line in the march of progress to give more than momentary consideration to the spectacular advance of these alloys into importance of first magnitude.

During the past few years, we have gone over various discussions presented on hardness and hardness testing, and we believe that the best definition of hardness is as follows:

> By hardness is meant that property of mechanical resistance that is possessed by the outer layer of solid bodies.

With Nitralloy the consumer may ask the following questions:

What is the thickness of the nitrided case? Is it brittle? What are the treatments? What are the commercial possibilities? and the most important question—What is its hardness and how does it resist abrasion and seizing?

It is apparently a simple matter to determine the thickness of the case by examining notched bars that have been broken. The depth of case is examined under a microscope with a Filar micrometer attachment.

The uniformity of the case may be determined by taper grinding the bars from one end to the other in such a manner that it starts with only 0.001 in. under the skin to a maximum of 0.05 in. Measurements are made along the bar that has been ground to correspond with this thickness.

With regards to the question of brittleness, it has been found that tons of work have been nitrided without developing brittleness of the case. This statement, however, must not be construed to mean that nitriding does not impart brittleness; it does, unless the necessary precautions are taken.

This brings us to the fourth question in regards to treatment and with particular regards to brittleness. From our experience we would answer the question by saying, that as the treatments produce varying shades of brittleness it is necessary to determine the correct treatment for the work at hand. It is our policy in connection with brittleness to put test bars in each load to be treated and to bend these test bars on a vise after treatment, to determine the brittleness or ductility of the case.

One of the most severe conditions that can be applied to nitrided steel is the operation of valves in the neighborhood of 900 deg. F. and the opening and closing of these valves under unbalanced pressure. Another instance that may be cited with regards to the wear resistance of nitrided steel, is that a number of these valves were placed in an oil refinery handling slury. Previously, the valves lasted ten days on this service. Nitrided steel valves have been in service four months and are in just as good a condition as they were when they were first put into service.

Destruction tests of the material are also made from the various sections of the furnace so that the ductility and the depth of the case may be noted in the actual work under treatment.

In a wear testing machine test blocks were rubbed together 35,000 times with no lubricant at 200 lb. per sq.in. pressure and the wear noted.

Stainless Properties

This nitrided case is fully as resistant as stainless iron to the corrosive action of fresh and salt water or moist atmosphere, and is second only to stainless steel or that type of alloy in resistance to hydrogen sulphide gas. On account of its superior forging, machining and wearing qualities, this steel, therefore may be regarded as an important addition to the family of rustless metals.

The Nitriding process consists of subjecting finished machined parts made of special steel to the action of ammonia gas at low temperature, so that they are surface hardened to the depth required. The properties of this type of steel possessing extreme hardness and wear resistance combined with a tough core, having good impact and tensile strength, without material deformation or distortion, has been for many years the goal of both makers and users of steel for certain specific requirements.

The Use of Electricity in the Heat-Treatment of Metals

By Carl J. Ipsen
Welding Engineer, General Electric Co., Schenectady

Perhaps the most extensive use for which furnaces are required today is in the heat-treatment of steel forgings and machined parts. Modern automobiles, for example, require a large number of carefully heat-treated parts, and the volume of production combined with the rigid requirements as to quality and uniformity, makes this industry an outstanding one in this respect. Although not all of the automobile plants are equipped with electic furnaces for heat-treating, many of them use electric furnaces extensively or exclusively for this purpose. This is also true of plants which manufacture agricultural implements and tractors.

The fact that electric furnaces can be located at the most advantageous point for the routing of material, adjacent to the machine tools if desired, often makes considerable savings possible in the cost of handling and increases the rapidity of movement.

The operating characteristics of electric furnaces as regards the absence of noise, excessive heat and products of combustion in the atmosphere, the accuracy of temperature control, the safety and cleanliness are now generally well known. Their reliability in operation and low cost of maintenance are accepted without question, due to abundant records, but the cost of heating as compared with the combustible fuels is still a subject of discussion.

The relative cost of heating will depend upon the type of furnace under consideration, the temperature, the operating cycle, the rates prevailing in the locality and other factors having an influence in the specific case. The cost of heating, however, is only one of the items entering into the cost of operating the furnace, and in any case is a very small item in the cost of manufacturing the product—usually about one per cent—so that any improvement in quality or other advantages to be gained by using a higher cost fuel might more than offset the difference in fuel cost.

The furnace should therefore be viewed in its true relation, that is its effect on the cost, the quality and the value of the product, and not merely the efficient utilization of fuel.

While it is true that electricity is the most expensive fuel on a B.t.u. basis, it is also true that in many cases furnaces can be maintained at temperature and work done at a lower cost with electric heat than with combustible fuels, for heat alone. As an example take the ordinary box-type furnaces, hundreds of which are in daily operation. Many of these are used in tool rooms or for other purposes which require them to stand idle a large part of the time, but they must be maintained at temperature and ready for use at all times. Comparatively little of the heat is actually used, by far the greater part being the losses.

Gear Ratios Stressed at S.A.E. Meeting

FOLLOWING the custom of divorcing the annual meeting from the New York Automobile Show, the Society of Automotive Engineers held its 1929 annual meeting in Detroit, at the Book-Cadillac. Standards, research and society business occupied the first day. Standards presented included aeronautic, agricultural, electric, motor boat and other divisions of automotive activity, while research dealt with vapor pressure of gasoline, fuel volatility, engine acceleration, and headlight problems. At the foreign automotive transportation session Clarence M. Foss presented an outline of a paper prepared by himself and J. D. Mooney, president of General Motors Export Co., that pointed out the problems of foreign sales and suggested the building of a smaller and cheaper car for many of the foreign markets. Motion pictures showed assembly plants all over the globe.

Transmissions, fuels and lubricants, and bodies occupied another day in which axle ratios and transmission steps were discussed by builders of gear-sets and such well known engineers as H. M. Crane of General Motors, E. S. Marks of Franklin and J. J. Wharam of Lincoln. The discussion was of special interest in view of the changes in transmissions in this year's cars, in the increased use of four-speed transmissions and in gear ratio changes in the newer three-speed transmissions that eliminate the old low gear and lower the other ratios.

The No-back device for automatically preventing a car from rolling backward on a grade was described in detail and elicited considerable discussion. While primarily designed for hilly country it is said to be found very useful in eliminating the necessity of even slight braking in traffic stops, unless the car is headed down grade.

Measures Gear Noise

F. A. Firestone also demonstrated the apparatus used in measuring both the pitch and the volume of gear noises. Best of all, from the practical point of view, he told how it was being used in testing machines using gears, in various factories. It not only detects noise gears but it tells the inspector which pair of gears in a train are the offenders and enables them to be replaced with minimum delay and expense.

Lubrication discussions included the presence of gum in gasoline, measurements of detonation, fluidity of lubricating oils and the growing problem of better chassis lubrication. The first three were of great interest to designing engineers, while the last subject affected car users as well.

At the body session the papers dealt with ventilation and heating, vibration and rumble, and color, in which Dr. A. C. Hardey presented a color analysis for use in securing exact duplication of color. The analysis is known as the recording spectrophotomer, its name giving an idea as to its operation.

Engine research occupied an entire session and included four paper dealing with valve spring surge; idiosyncrasies of valve mechanism; indicator cards and the DeJuhasz indicator. The chassis session dealt with balloon tires, frame and body vibration, uniformity of brake lining and front wheel alignment.

A special session was held at the Chrysler Engineering Laboratory under the sponsorship of the Chrysler Engineers Club. The paper was by H. T. Woolson, chief engineer of the Chrysler plant, with addresses by Walter P. Chrysler and Fred M. Zeder, president and vice-president, respectively, of the same organization. Motion pictures and an inspection of the laboratory followed. Transportation was furnished by special motor coaches.

Engines were also featured at two other sessions, each having three papers on various phases of the subject. Anti-knock fuels from the economic viewpoint; high-compression engines and their ignition problems; dual carbureters and manifolds; humidity and engine performance, engine torque and bore-stroke ratios were discussed from various angles as all these problems are the subject of much careful study by all the builders.

There was but one session at this meeting at which production papers were presented, including developments of chromium plating (reviewed elsewhere); steels for automotive use; production grinding and its most recent developments, accompanied by a motion picture showing abrasives, or the jewels of industry.

One of the most interesting and startling developments brought out was the Temple high-velocity penetration device, named for its inventor. This utilizes the power generated by a comparatively small charge of explosive, sporting gun-powder in this case, to drive a steel pin or bolt through steel plates of varying thickness up to two more inches in the samples shown. Developed for use under water by divers, it is also available in many other fields and probably has many more applications than are now apparent.

French Industry Faces Shrinking Exports

By Our Paris Correspondent

RISING prices in most manufactured lines are an indication that franc stabilization is bringing about that which was feared: An increased wage scale in perspective will open the door in the long run to increased imports, something which France, above all European countries, seeks to avoid. Both wholesale and retail prices are affected and labor's living costs have risen 85 points since October 1927. Export sales fell off during the first nine months of the last year 1,200,000,000 francs, the bulk being on manufactured articles. French prices instead of longer being statically under-the-market are frankly heading for the close competitive class.

Some labor unrest is already showing itself in the metal trades in the Paris district, affecting chiefly, on a small scale at present, the automobile industry, probably of communistic political purport rather than economic. One firm met the proposition for a wage increase without argument and granted an increase of 25 centimes per hour, which showed in this particular case a desire to avoid any curtailment of current business, whatever the future was likely to bring forth.

France is recognizing more than ever that the metallurgical and metal transforming industries are the basic indexes of prosperity. Captains of industry complain, however, that adequate returns, either on invested capital or for labor, are not what is indicated they should be when the American situation is compared.

The one chief weapon in their minds is an increased protective tariff, but they ignore the fact that increased output by machinery is an even greater factor of prosperity, as they also ignore the possibility of increased production and lower prices, which in the final analysis will give both elements a greater return for their interests.

There is still a well-defined movement on the part of industrial engineers here for a better appreciation of their efforts both as designers and producers, and the question of better pay is cropping up all along the line.

Steel sheets from abroad both for stamping and drawing are showing increased imports from the United States and Germany.

The international wire cartel, having adopted a fixed price for machine wire, evidently intends this as a minimum as quotations on many gages exceed the established list prices. A new convention is expected to result from the next meeting to be held in Paris or Luxembourg in January.

Foundry orders for the machinery trades are said to be less in bulk and value, indicating a slowing down at the moment, thought it is claimed that the machinery industry *per se*, referring particularly to the larger and better-known makers, is satisfactory. It is even suggested that the automobile industry is looking to French makers for the supply of many of the simpler forms of metal-working machinery hitherto bought abroad.

The above hardly suggests or coincides with the fear of increasing manufacturing costs, but on the other hand it must be remembered that the import of machinery from America, and to a lesser extent from England and Germany, is taxed with heavy transporta-

tion charges to begin with. One distributor of American machinery in Paris recently emphasized this point and suggested that some sort of price adjustment was due in an effort to equalize these conditions.

The case is cited of a large automobile manufacturer who has placed orders in Germany for machine tools to the value of several million marks on extended credit terms. The British machinery consortium, referred to in these columns a couple of months ago, is believed to be booking satisfactory orders through its Paris branch.

There is a rumor that the Voisin firm, manufacturing a high-grade French car, has entered into a combination with the Daimler-Benz of Germany.

The Society of French Automobile Engineers, continuing its constructive research work, is studying the organization and functioning of improved machinery as applied to its industry.

The Amilcar organization, into which the genius of W. C. Durant has recently entered under a more or less occult form, is installing a new steel body plant which will give an increased production of 60 per cent.

The electrical industry is exceedingly prosperous in most of its branches, encouraged by government electrification schemes.

Steel railway car construction is making headway with French firms already receiving important orders for delivery in 1929.

Improved Hand Tools

Steel construction elements in the building and allied industries are ever calling for the greater use of improved hand tools and devices. Due to the vast government building program many manufacturers of such elements have orders in hand for some months operation ahead. The recent disasters in reinforced concrete construction in France seems to be pointing the way to a larger use of steel construction units and steel furniture, partitions and the like, as in the United States.

The American "Parkerizing" process against rust has recently been adopted by many French manufacturers, notably by the repair shops of the leading railways and the automobile industry, of which Hotchkiss, Peugeot, Ballot, Citroen and others may be mentioned.

The French Timken Co. is preparing to manufacture at Asnières in suburban Paris and is undertaking a campaign to popularize tapered roller bearings through its 23 distributing centers.

Import of small tools has been falling off in recent years, and French makers appear to have turned to their manufacture here and caught up with local demand for breast drills, small vises, braces and bits. The country is still tributary to America, Germany, and to a lesser extent to Great Britain, for metal-cutting saws, files and certain other small items but it is evident that this phase of the export trade in metal-working tools is dwindling in this market. One large American manufacturer of heavy machine tools said, however, that it didn't matter much anyway since the volume was small in value. It may be said, however, that it was really important and it does seem to have largely slipped away. The lower price factor, increased in the case of foreign tools by heavy customs duties, has brought about the situation and enabled the French manufacturer of such lines to copy many American specialties though not of equal quality.

Manufacturers of woodworking tools are transforming and modernizing their production methods here and standardizing on many items and in other cases eliminating them altogether. Prices are ridiculously low and the business has for some time past been in the violently competitive class. The consuming public in these lines, as for hand tools for metal working, is believed to be ready for a better article at a higher price. It is apparently not too late for American makers to recover some of their lost market.

1929 New Haven Show Cancelled

The General Committee of the New Haven Machine Tool Exhibition, Inc., has decided not to hold the Eighth New Haven Machine Tool Exhibition, tentatively announced for 1929. The show was canceled in view of the fact that the National Machine Tool Builders' Association is to hold its second show in September, 1929, at Cleveland. Realizing that two large exhibitions in the same field during one year are probably unnecesary, the general committee decided to withdraw from the field this year.

At the time of its inception, in 1921, the New Haven Exhibition was organized as an educational enterprise working for the interests of the machine tool industry, which was at that time without an annual exhibition.

Anticipate Expansion of Delco-Remy

Further expansion of the Delco-Remy plants of the General Motors Corporation at Anderson, Ind., is regarded as certain following an address recently by C. E. Wilson, retiring president, who was tendered a banquet by business interests there prior to leaving for New York where he becomes assistant to Alfred Sloan, president of General Motors. Mr. Wilson stated that Delco-Remy paid out $11,000,000 for payroll expense during 1928 and that at the close of the year nearly 10,000 persons were employed. He said Delco-Remy in Anderson produced 2,561,000 sets of electrical equipment out of 4,750,000 used for motor vehicles used in North America during the year.

Caproni-Curtiss Merger Rumored in Wall St.

According to the *Wall Street Journal*, the Curtiss Aeroplane & Engine Co. is expected shortly to announce an affiliation with Caproni Aviation Co., of Italy, one of the largest aviation firms in Europe. A new company, capitalized at $4,000,000, will control all the patents and designs for the exclusive manufacture and sale of Caproni seaplanes and airplanes. This step, if taken, will follow along the path taken by several other American companies who have acquired the right to build motors under license of foreign firms.

Two British motors are being so built here, and only last week it was announced in Indianapolis that the Wright-Tuttle Aircraft Motors Corporation has secured the rights to manufacture the Renard aircraft engine, now being made in Brussels, Belgium. It is a static air-cooled engine of 100 hp. D. J. Deschamps, of Antwerp, will be chief engineer and vice-president of the company, which is to begin production as soon as the organization is completed.

Warner Operations High

While operations of the Warner Aircraft Corporation were rather limited in 1928, this year it is expected that the company will go into active production of the 100-hp. Scarab engine, with shipments estimated between 500 and 1,000 engines, depending upon the rapidity with which production facilities are enlarged. Already orders are on hand for 750 motors, so that the present problem is not one of obtaining business, but of increasing production to meet the demand. Recently 10 acres of land was purchased near the Detroit factory, and a $150,000 building is to be constructed there. While all machining work is now being done by outside concerns, Warner expects to do all its own machine work as soon as facilities are available.

Soviet Seeks Data on Automobile Plants

Negotiations are now under way with American interests for the construction in Russia of a large automobile manufacturing plant capable of turning out 100,000 cars a year. It is understood that an effort will be made to interest either the Ford Motor Co. or the General Motors Corporation in the enterprise. Aaron L. Schienmann, chairman of the board of the State Bank of the Union of Socialistic Soviet Republics, who recently arrived in this country for the purpose of raising the necessary funds, is also interested in American methods. No doubt the plant will be constructed along American lines, and will probably have American production equipment. Mr. Schienmann has his headquarters with the Amtorg Trading Corporation, 165 Broadway, New York.

BUSINESS BAROMETER . . . . . *Rising*

commodity prices indicate start of inflation period, but stock speculation is still the chief concern of business

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

IN THIS section a few weeks ago, it was said that the price of the staples of human consumption must soon advance if the rise in security values is to continue.

It has also been pointed out at various times that the advance in securities has been made possible only by an inflation of credit, and that, while the usual elevating effect of this inflation upon commodity prices has thus far been inhibited, all precedents will be violated if the boom does not spread to commodities before deflation finally is begun.

And, third, mention has been made of the virtual certainty of passage of farm relief legislation, which sentimentally or otherwise is expected to improve prices for many of the agricultural staples that the country produces.

These statements included no specific prophecy, and the only evidence in support of their correctness, which has been available until now, was the sharp advance in copper and a gradual increase in the price of corn. But during the past ten days or so corn has risen more rapidly, there has been a perpendicular and wholly unexpected advance in wheat and an equally sensational jump in rubber.

Statistically each of those commodities is weak, and to account for the advances the market commentators are compelled to fall back on statements that they are due to "public speculation" and to "short covering." But "public speculation" is exactly what is to be expected when the levitating influence of inflation begins to exert itself, and "short covering" is a euphemism to describe a condition of scarcity that may exist no matter how large the supply when an even larger amount has been sold.

Therefore it may be that the advance in these four major commodities is an indication that the yeast of inflation is beginning its work. If so, it is obviously the most important business news of the present time, and merchants and manufacturers will do well to consider all its ramifications.

The first probability is that the prosperity and the enormous purchasing power of the United States, and to a lesser degree of the rest of the world, will be reflected, as soon as the preoccupation with security speculation is ended, in an enlarged demand for goods of all kinds, which must first elevate the price before it can stimulate additional production.

No elaborate exposition of this theme is necessary, but it may be said that, as the prosperous northern countries are taking more from the tropics each year, the tropics are also taking more of the products of the cooler climes. The throb of commerce is being felt more intensely everywhere, in Africa, Asia and Latin America, and the increase in our exports in 1928 to a value of above five billion dollars, the highest since 1920, has a counterpart in the enlarged consumption of most of the world.

The second probability is that the upward trend in these commodities will quickly spread to others in which the price or the statistical position, or both, furnishes good reason for an advance and for more general forward buying than is now practiced.

But if these considerations make it appear likely that 1929 will be a year of advancing commodity prices, it must be admitted that there is a "lion in the way," in the persistence of the stock market speculation and the absorption in it of most of the people of the United States who have money or who can borrow any. This absorption is so universal that the temporary effect of the inevitable break in stock prices, when it comes, may be to depress the commodities rather than stimulate them.

This is but one of many reasons why the stock speculation must still be the chief concern of commerce and industry. It is more true now than it was at the beginning of December that a reaction in stocks would be the best thing that could happen to business, for as expectations are always worse than the realization, they are ever more depressing. As time goes on and hope of a salutary reaction is deferred, it seems more likely that only a combination of still higher money rates and signs of declining business will bring it about. Of the former it is sufficient to say that there can be no hope of lower rates, as long as the Reserve Banks set their face against the continuing absorption of credit by the security markets, and the Brookmire Economic Service predicts that a monetary crisis will occur in 1929, possibly as early as the Spring.

Of business the weather report still reads "increasing trade winds," for a further expansion in steel output has occurred, the automobile manufacturers are living up to their promise to start off on the largest half-year's production the industry has ever achieved, and of the three major industries the only laggard is building, which will eventually drag down the others if its decline continues. In textiles the volume of orders is not quite reaching expectations, and the rate of operations in the tire industry is held to be disappointing.

But there are always some discords in the chorus of prosperity, and on the whole the song is one of praise. Distributive trade is good, and there is no reason to doubt that the prophecies of a record first quarter will come true.

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

SALES of machine tools are continuing at a speedy pace throughout the country, and inquiries indicate that buying will continue for some time. About the only drawback to the present prosperity of the machine builders is the fact that the delivery situation becomes daily worse as the bank of unfilled orders increases. The use of overtime and night work is offset to a considerable extent by the effects of influenza, which is curtailing the ranks of the employed in many centers.

PLENTY of orders and inquiries are to be found by Cincinnati builders, the chief demand coming from the automotive shops. A similar situation exists in Detroit, where employment is on the increase, and all shops, including the small ones, are busy. Numerous orders for one or two tools are being received by New England builders, who are working overtime against back orders. Scattered demand is found in the Chicago district, with the aggregate volume satisfactory. The same statement is true of the New York market.

RAILROADS in the Chicago district are feeling out the market, and lists are expected to be issued shortly. It is anticipated that buying against such lists will take place over a period of several months so that an active half year is probable for firms catering to this class of buyer. Railroad buying is also a factor in Indianapolis, where the trade is slowly recovering from the holiday slump. The automobile body shops are active buyers, but the engine builders are not as active as elsewhere.

EQUIPMENT orders from the railroads feature Canadian metalworking activity, and industrial expansion of all kinds is prevalent.

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The Industrial Review

The week's progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

INDIANAPOLIS

The machinery and machine tool trade here is slowly recovering from the holiday slump. The general outlook, however, is much better than it was this time last year. Some soft spots have developed since the holidays due to suspensions in some of the factories for inventory but they are being eliminated rapidly as the plants get back into production.

One of the best markets in Indiana at the present time for special machinery is the radio cabinet industry. Virtually all the factories are working to capacity, and they are buying special woodworking machinery, small lathes and similar equipment. Another active market is the automobile body industry. During all of last year this market, both for metal and wood bodies, was active and the new year has started in fine shape. At these plants it is stated that 1929 will be a better year than 1928 unless something drastic occurs.

The railroad business is fair. The roads are buying their requirements, and from present indications they will be larger than last year. Some of the shops in Indiana that have been partially or wholly closed down have increased the number of their employees, and the general repair programs are somewhat heavier.

Right now the state seems to be a good market for brick making machinery. Several brick and tile plants have curtailed their operations during January for the specific purpose of making new installations to prepare for the spring demand.

The automobile industry shows little inclination to make purchases now. After the Chicago show, however, it is believed they will increase their production. This is true particularly of Indianapolis, but Chrysler and Studebaker and Auburn plants are working at capacity.

CANADA

The bright spot in the metal-working situation in Canada at present is the increasing flow of new equipment orders from the railroads. The general industrial expansion throughout the Dominion and the expansion of foreign markets have resulted in increasing demands upon the railroads which their present rolling stock is unable to meet, and the equipment companies are reaping a delayed harvest of orders as a result. Another favorable factor is the belief that the Canadian railroads will follow the example of the leading United States lines and gradually replace all existing wooden box cars with steel rolling stock, and it is estimated that, in this event, at least ten years of good orders are ahead of the equipment companies.

A program calling for an expenditure of more than $7,000,000 in maintenance of way and structures on the Atlantic region of the Canadian National Railways has been announced. The rail mill of the Algoma Steel Corporation has started on double turn, this being the first time since the post-war period that the rail mill has operated on double turn so early in the year. This is due to the urgent demands from the two large railways for early deliveries of rail.

Illustrating the marked growth in bridge business, the president of the Dominion Bridge Co. recently reported that in the mechanical and engineering department during 1928, sales were made of: 8 grain car unloaders; 78 hydraulic regulating gates; 46 electric traveling cranes, and other work of like character which brought the total value to $2,000,000.

It is reported that Canadian Vickers are planning to go into the aircraft business in a most extensive way this year. The company will produce planes for commercial use, as well as for government services.

Discussing the outlook for the machine tool business recently, H. G. Bertram, of the John Bertram and Sons, Ltd., Dundas, Ontario, said: "Business during the last year was quite satisfactory and we look forward to the present year as being equal to 1928 and perhaps slightly better. A pleasing feature of last year's business was the purchases by a more diversified list of customers. This indicates a much broader prosperity than in former years."

CINCINNATI

The past week was a very satisfactory one, according to reports of machine tool manufacturers of the Cincinnati district. "Plenty of orders were received, as well as a large number of inquiries," stated the head of one concern. "We made some gain in the week and the outlook seems better in every way," said a second. "Business stepped up with us quite a bit," said a third. "Our sales were at a good level and things are looking better every day," said a fourth. "We had a good volume of sales, with orders from all sections, from the Atlantic to the Pacific," said a fifth. Reports of other manufacturers were of the same tenor.

Selling agents report a better-than-fair demand during the week in local and adjacent territory. "The market is livening up," stated one, "and in my opinion the outlook for a much greater demand is very bright."

A feature of the week's business was the demand from the automotive field, from which came a number of single orders, as well as several that called for two tools or more.

An excellent volume of well-diversified inquiries were received in the week. The majority of these were from general machinists and miscellaneous users, but an increased number of inquiries came from the automobile industry and its allied trades, some of which called for several tools.

NEW ENGLAND

Machinery and machine tool sales continue in the New England section at a healthy pace, and the forward tendency strengthens. Orders are numerous for one and two tools with the week producing no large lists. The total volume is most encouraging. Inquiries are coming in increasing numbers with promise of one or two larger lists being placed shortly.

Equipment dealers are turning over a good supply of rebuilt machines. In some industrial centers grinding units have been hard to get, and one dealer at least reports a real shortage. Small automatics are going well with the past week showing a definite increase in demand in this territory.

Manufacturers of machine tools, despite full speed schedules, are making but little impression on lists of unfilled orders. Delivery on high-speed production units is in some cases being extended to two months. All of which would indicate leading plants, producing this type of machinery, to have upwards of three months' work on their files.

Machine shops throughout the territory are beginning to look more seriously toward the betterment of their own equipment. It is certain a great deal of equipment is badly in need of replacement, and buying from this source is to be more prominent. A number of additions are also being built for which new equipment is required.

DETROIT

Thus far the month of January gives every indication of being at least as good and probably better than January of 1928, which was an unusually good month. The machinery and machine tool dealers in this area are particularly pleased with the showing made and with the prospects for business during the next few weeks or months.

Many good sized orders are coming in, and a great many inquiries are being received from the automotive plants. There is a generally healthy condition existing which is considered unusual here because of the fact that last year was so extremely prosperous. Employment is advancing and business in general is very good.

The small shops are still working overtime, although they are not getting as many orders as they did in the last few months of 1928. The big industrial plants are very active, however, and indications are that there will be many changes and at least a few expansions before the first quarter of 1929 is ended.

CHICAGO

The machine tool market continues on a steady basis, the volume of business being practically on the same level as for the last several weeks. The taking of inventories, now completed in many cases, seems to have had little bearing either on the inquiries or orders coming in. As noted last week demand is from scattered sources. Punch presses are reported by some machinery dealers to be leading other tools in the matter of demand, but there appears to be no diminution in the call for milling machines, drills, planers and shapers. Small tools, also, are being inquired for in increasing number. Deliveries still are very backward, with no indication that there will soon be an improvement in the situation. No advances in prices are reported with the exception of chucks, which have been advanced 5 per cent.

Railroads are starting to send in tentative inquiries, and, from what can be gathered, within a short time will be mailing preliminary lists of shop requirements. The Santa Fe, and the Chicago, Milwaukee, St. Paul and Pacific are said to be the leading prospective buyers thus far heard from. The opinion prevails that such orders as may come from the railroads will be spread over a series of months, instead of being grouped in two or three big lists at the beginning of the year as has been the rule in previous years. Dealers specializing in used tools are well satisfied with present market conditions, reporting a steady demand for their goods.

NEW YORK

A good volume of well-scattered orders featured the machine tool market in the metropolitan district in the past week, with no orders of any considerable size being noted. Several leading dealers report such a condition, and another states that while the business received to date has not been large, the number of live prospects in hand indicates that the month's volume will be comparable with that of late months in 1928. Both dealers and factory

representatives assert that the delivery stiuation is becoming more acute every day. The situation is being aggravated, according to one, due to the influenza epidemic which is cutting into the ranks of employees of the machine tool builders.

The "Flu" is also having its effect upon local buying, through the absence of key men, and production in the local metal-working shops is being curtailed. The General Electric Co. is said to have 2,000 persons out on sick leave from the Schenectady Works.

The Bloomfield Works of the General Electric Co. bought some tools this past week, including a radial drill and an upright drill. No further buying on the part of R. Hoe & Co. was noted. In the past few months this firm has been one of the most important buyers of equipment in this market. It is estimated that over $250,000 worth of shop equipment has been purchased, including planers, grinders, milling machines, shapers and lathes. Further buying in the lathe line is anticipated.

The Pratt & Whitney Co. reports the sale of: three jig borers, six lathes, one drill, two die sinkers, one vertical shaper and a bench miller. The Niles Tool Works Co. sold in the past week a boring mill, an axle lathe, an engine lathe and a locomotive journal-turning lathe.

Tentative Standards Proposed by A.S.M.E.

A tentative standard for spur gear tooth forms, covering the 14½- and 20-deg. full-depth involute system has been completed by a committee of the American Society of Mechanical Engineers, and is being distributed for criticism under the American Standards Association designation, B6b—1929. A committee of the American Gear Manufacturers Association co-operated in the work of preparing the standard.

Three tentative standards on milling cutters also have been prepared by a sectional committee on the standardization of small tools and machine tool elements of the A.S.M.E. Proposed standard A.S.A. B-5c1—0000 covers plain, side, angular, stagger-tooth, end mills, metal slitting, T-slot and halfside cutters. Proposed standard A.S.A. B-5c2—0000 covers involute gear, stocking, fluting reamers and taps, concave, convex, corner rounding, and sprocket cutters, while proposed standard A.S.A. B-5c1 covers nomenclature for milling cutters. There is also a proposed standard for keys and keyways for milling cutters and arbors.

Anyone desiring copies of the proposed standards for purposes of criticism or discussion should communicate with C. B. LePage, assistant secretary, A.S.M.E., 29 West 39th St., New York.

Big Dry Dock Merger Confirmed

Confirmation of the formation of United Dry Docks, Inc., New York, was recently given in a financial advertisement in which 450,000 shares of no-par common stock of the corporation was offered the public. The corporation has been formed to purchase the physical assets of six dry dock companies located in the New York Harbor, consisting of Morse Dry Dock & Repair Co., James Shewan & Sons, Inc., W. & A. Fletcher Co., New York Harbor Dry Dock Co., Inc., Staten Island Shipbuilding Co., and Theodore A. Crane's Sons Co. The total purchase price of these properties will be about $20,000,000. The units acquired control 27 dry docks. One of the chief reasons behind this merger is the fact that dry dock rates in New York Harbor are 5c. per ton as compared with 10 to 16c. per ton elsewhere, other charges being in proportion. The object, of course, is to strengthen the present rate.

E. P. Morse, president of the Morse Dry Dock & Repair Co., is president of the new corporation and George H. Bates, of the Staten Island Shipbuilding Co., will be associated in the management. Both men are of long experience in ship repair work.

Safety First!

With a view both to safeguarding the lives of its employees, and to protecting its weekly payroll from the forays of armed bandits, prevalent in the district, McKaig-Hatch, Inc., of Buffalo, N. Y., manufacturer of tools and drop forgings, has adopted the system of paying employees by check instead of by cash.

Business Items

The Haynes Corporation of Cleveland, with offices in the Union Trust Building, Cleveland, Ohio, was recently formed to represent the Haynes Corporation in the northern half of Ohio, the eastern part of Michigan, and the western portions of New York and Pennsylvania. The Haynes Corporation, industrial engineers, are the originators of the Haynes Manit System for measuring and directing manpower. George J. Willman, formerly manager of the Cleveland office of the Haynes Corporation, has been made president and treasurer of the newly formed concern, while T. J. Phee, for several years supervising engineer for the Haynes Corporation in the Chicago territory, has been made vice-president and secretary of the new company.

The Gamewell Corporation, Massachusetts, has acquired the Harrington-Seaberg Corporation, Moline, Ill., manufacturer of fire and police alarm systems, on a reported trade basis of share for share, and is expected to expand the Moline plant to nearly double its present production capacity, probably limiting the Moline factory to traffic control devices and sign flashers. With its recent acquisition of the Holtzer-Cabot Electric Co., Boston, the Gamewell Corporation is dominant in the police and fire alarm field.

The National Steel Car Corporation, Hamilton, Ont., is making plans for expansion to facilitate the manufacture of parts of automobiles, chiefly frames. In this connection the company has recently concluded the purchase of the Windermere Park property, in Hamilton, comprising 38 acres, at a cost of $100,000 and will erect several buildings. Canadian automobile firms, it is stated, have placed large orders with the company, and consequently it has been found necessary to expand.

The Consolidated Manufacturing Co., Terre Haute, Ind., manufacturer and distributor of window ventilators, will move to Quincy, Ill., within the next fortnight, occupying the Economy Enameling Co. plant, which for some time has been producing parts for the Terre Haute concern. Emmett Wilson, head of the Quincy company, will become general manager of the Consolidated Manufacturing Co., of which D. R. Wood is president.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., manufacturer of electric motor controls, power devices, and similar products, has changed its name to Cutler-Hammer, Inc., a Delaware corporation. F. R. Bacon is chairman of the board; B. L. Worden, president; F. L. Pierce and J. C. Wilson, vice-presidents; H. F. Vogt, treasurer; and W. C. Stevens, secretary. The Cream City Foundry Co. is also included under the new title.

The Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa., has taken over the assets of the R. D. Nuttall Co., also of Pittsburgh, as of Jan. 1, and will carry on the operations of the Nuttall company as a branch of the Westinghouse company. The Nuttall plant will be known as the Nuttall Works of the Westinghouse Electric & Manufacturing Co. and the product will be called Westinghouse-Nuttall.

Expansion plans for the Peoria plant of the Caterpillar Tractor Co., which will double its output in a few months, were recently announced. As a result of the introduction of straight-line manufacturing methods in this plant wide price reductions have been made possible with a consequent increase in sales. Several new models are also being brought out.

Veeder-Root, Inc., has consolidated its purchasing under J. M. Brown, purchasing agent at the Hartford plant. B. W. Aspelin, formerly purchasing agent at the Bristol plant, is now purchasing agent for the Hartford Machine Screw Company.

The Watson-Stillman Co., 75 West St., New York City, manufacturer of hydraulic machinery, has appointed the Midvale Mining & Manufacturing Co., St. Louis, as its representative in that district.

Articles of incorporation have been filed by the Keely Die and Tool Co., of Goshen, Ind. The corporation is formed "to purchase, manufacture, repair and sell tools, dies, jigs, fixtures and special machinery." It has an initial capital

stock of $25,000 and the incorporators are Guy J. Keely, Jerome F. Keely, Annette L. Brumbaugh and Clell E. Firestone.

Plans are being considered for the sale of the Amherst Automatic Machine Co., Amherst, Ohio, as part of a proposal for reopening the Amherst Savings & Banking Co., largely because the machine company has received a large amount of accommodation paper from the bank. W. H. Schibley is president of both the bank and the manufacturing company.

Announcement is made that a reorganization of the Consolidated Steel Strapping Co., of Chicago, has been effected, the name of the concern being changed to the Signode Steel Strapping Co., with a capitalization of 250,000 no-par common shares, and 100,000 shares of $30 par preferred stock with a cumulative dividend rate of $2.50 per year.

Letters of incorporation have been granted to the Bendix Service Corporation, 105 W. Adams St., Chicago, to manufacture and sell machinery, automotive, mechanical, and electrical equipment. Capital, $1,000,000 class A, and $1,250,000 class B common. Incorporators: W. H. King, Jr., H. J. Pickering and Emil Christiansen.

The Lubricating Equipment Co., 624 S. Michigan Ave., Chicago, has been incorporated to manufacture and deal in lubricating equipment and machinery. Capital, $10,000 preferred and 1,500 shares common no-par value. Incorporators: B. L. Kibbey, R. Leider and H. C. Kibbey.

The Ziv Steel & Wire Co., Chicago, Ill., has opened an office and warehouse at 31 East Georgia St., Indianapolis, Ind., in charge of John D. Hall, manager. A complete stock of high-speed and carbon tool steels, hollow drill and cold rolled steels will be carried.

The Locomotive Terminal Improvement Co., 80 E. Jackson Boulevard, Chicago, has bought from Spencer Otis, its president, a tract of 3 acres, improved with four buildings, in Barrington, Ill., where it will manufacture all-steel airplanes.

The Blaw-Knox Co. has purchased the W. H. French Co., of Chicago, manufacturer of road building equipment. About $1,000,000 is involved in the transaction. No new financing will be done by Blaw-Knox.

Directors of the Wisconsin Parts Co., Oshkosh, Wis., have approved the sale of the company to the Timken-Detroit Axle Co., whose stockholders will vote on the proposal Jan. 22.

Expansion of the Williams Oil-O-Matic Heating Corporation, Bloomington, Ill., by erection of two new buildings which will add 50,000 sq.ft. to the plant floor space, was announced at the stockholders' meeting last week in Chicago.

Obituaries

JOY LOVE, aged 72 years, president of Love Bros., Inc., and the Aurora Foundry, one of the oldest native residents of Aurora, Ill., died Jan. 9 in his home there after an illness of a year. His brother, John, who had been his partner for half a century, and he started their first venture in 1876, opening a foundry in a small shed, which was succeeded in eight years by a larger building, the nucleus of the present plants.

WILLIAM G. ALLEN, president of the Independent Aetna Sprinkler Co. and the Automatic Sprinkler Co. of Canada, died in New York recently at the age of 56. In 1914 he organized the Niagara Sprinkler Co., which was later consolidated with five other companies into the Automatic Sprinkler Co. of America.

Personals

EMMETT J. COLE, superintendent of shops of the Union Pacific at Omaha, Neb., has been made assistant to the general superintendent of motive power and machinery with jurisdiction over the entire system, headquarters being at Omaha. OTTO JABELMANN, superintendent of shops at Cheyenne, Wyo., succeeds Mr. Cole at the Omaha shops, and R. H. FASEN becomes superintendent of shops at Cheyenne.

J. H. BRUNKHORST, assistant shop superintendent of the Sedalia (Mo.) shops of the Missouri-Kansas-Texas, has been promoted to shop superintendent at that point in place of William Walker, who retired Jan. 1. F. W. STEVENS becomes assistant shop superintendent at Sedalia.

E. W. RYAN, formerly vice-president and general manager of the Central Manufacturing Co., Connersville, Ind., has been elected vice-president in charge of operations of the Auburn Automobile Co., at Connersville.

HERBERT M. BRAY, who for the past five years has been manager of the Chicago office of the Colonial Steel Co., Pittsburgh, Pa., has been appointed assistant sales manager in charge of the midwest branches.

RALPH E. FLANDERS, manager of the Jones & Lamson Machine Co., Springfield, Vt., is to deliver a talk, "Use of Automatic and Semi-Automatic Machines," in Plainfield, N. J., before the local section of the A.S.M.E. on Jan. 25.

J. E. DURSTINE has been appointed district sales representative for the Lincoln Electric Co., Cleveland, Ohio. His headquarters are at Birmingham, Ala. H. P. Egan is now district sales representative for central Ohio with headquarters at Columbus.

THOMAS A. BEATTIE has been appointed general superintendent of McKeesport (Pa.) plant of the National Tube Co., to succeed W. A. Cornelius, resigned.

ANDREW WELLS ROBERTSON, of Pittsburgh, has been elected chairman of the board of the Westinghouse Electric & Manufacturing Co., East Pittsburgh.

Forthcoming Meetings

AMERICAN MANAGEMENT ASSOCIATION. Production Executives' conference, Feb. 27-28 and Mar. 1, at the William Penn Hotel, Pittsburgh, Pa. Oscar Grothe, vice-president in charge of the production executives' division, c/o White Sewing Machine Co., Cleveland, Ohio.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Regional meeting in Knoxville, Tenn., March 21-22, 1929. W. R. Woolrich, professor of mechanical engineering, University of Tennessee, Knoxville, in charge of program.

AMERICAN WELDING SOCIETY. Annual meeting, April 24-26, at the Engineering Societies Bldg., New York. M. M. Kelly, secretary, 29 West 39th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Eastern spring meeting, to be held in Rochester, N. Y., week of May 13. Calvin W. Rice, secretary, 29 West 39th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Third national meeting of the Aeronautic Division, May 27-30, at St. Louis, Mo. Calvin W. Rice secretary, 29 West 39th St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Semi-annual meeting, July 1-4, 1929, in Salt Lake City, Utah. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

NATIONAL METAL EXPOSITION. Eleventh annual, held under the auspices of the American Society for Steel Treating, Cleveland Public Auditorium, Cleveland, Sept. 9-14. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

MACHINE TOOL BUILDERS EXPOSITION. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 826 Provident Bank Bldg., Cincinnati.

The Weekly Price Guide

Rise and Fall of the Market

PRACTICALLY all price changes of importance which occurred during the last two weeks, were advances. The minimum quotation on galvanized steel sheets rose 10c. per 100 lb., to $3.60, base, f.o.b. Pittsburgh. Solder, copper and brass sheets, wire, rods and tubing advanced about ½c. per lb. at New York warehouses. Cleveland prices were similarly affected in the fabricated brass and copper products. Electrolytic copper, small lots, is up 1c. per lb., to 17¾c., at New York. Non-ferrous metal scrap has quite naturally followed the upward trend in raw metals.

(All prices as of Jan. 18, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.50@17.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.75) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.06@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.55@2.65	3.60	3.40	4.00
No. 22	2.70@2.80	3.75	3.55	4.15
No. 24	2.75@2.85	3.80	3.60	4.20
No. 26	2.85@2.95	3.90	3.70	4.30
No. 28	3.00@3.10	4.50	3.85	4.45
Galvanized				
No. 10	2.80	3.95	3.75	4.25
Nos. 12 to 14	2.90	4.05	3.85	4.35
No. 16	3.00	4.15	3.95	4.45
No. 18	3.15	4.30	4.10	4.60
No. 20	3.30	4.45	4.30	4.75
No. 22	3.35	4.50	4.35	4.80
No. 24	3.60	4.65	4.45	4.95
No. 16	3.75	4.90	4.70	5.20
No. 28	4.00	5.15	4.95	5.45

*250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness Decimal Fractions	B.w.g. and	Outside Diameter in Inches ⅛	¼	⅜	½	⅝	¾	1	1⅛	1¼
		Price per Foot								
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23		
.049″	18	.17	.18	.19	.20	.21	.23	.25		
.065″	16	.19	.20	.21	.22	.23	.25	.27		
.083″	14	.20	.22	.23	.24	.25	.27	.29		
.095″	13	.21	.23	.25	.26	.27	.29	.31		
.109″	12	.22	.24	.26	.27	.28	.30	.32		
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33		
.134″	10	.24	.26	.28	.29	.30	.32	.34		

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.40	3.65	3.60
Cold drawn, flat or square‡	3.90	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	4.00†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, ⅜@½-in. thick. †250 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			17.75
Tin, Straits, pigs, New York			52.75
Lead, pigs, E. St. Louis	6.50	New York	8.00
Zinc, slabs, E. St. Louis	6.35	New York	8.00

	New York	Cleveland	Chicago
Antimony, slabs	12@13	12.75	14.25
Copper sheets, base	25.87½	25.87½	25.37½
Copper wire, base	22.25	22.50	18.12½*
Copper bars, base	24.37½	24.37½	24.37½
Copper tubing, base	27.12½	27.50	26.62½
Brass sheets, high, base	21.25	21.25	20.75
Brass tubing, high, base	26.12½	26.12½	25.62½
Brass rods, high, base	19.00	19.00	18.50
Brass wire, high, base	21.75	21.75	21.25

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	24.30	24.30
Zinc sheets (casks)	10.00@10.50	11.00	10.11
Solder (½ and ½)	35.00	34.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade			67.00
Commercial genuine, intermediate grade			53.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.25

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold rolled	53.00	40.00†
Tubing	75.00*	90.00
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper	14.87½@15.00	14.25	13.25 @13.75
Copper, heavy, and wire	13.75 @14.75	13.75	12.67½@13.00
Copper, light, and bottoms	12.50 @13.00	11.50	11.50 @12.00
Heavy lead	5.25 @ 5.50	6.25	4.75 @ 5.25
Tea lead	3.62½@ 4.12½	4.25	3.75 @ 4.25
Brass, heavy, yellow	8.12½@ 8.62½	9.00	8.25 @ 8.75
Brass, heavy, red	11.00 @11.50	11.75	10.75 @11.25
Brass, light	7.00 @ 7.37½	7.25	7.25 @ 7.75
No. 1 yellow rod turnings	9.25 @ 9.75	9.50	9.25 @ 9.75
Zinc	3.25 @ 3.75	3.25	3.00 @ 3.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†	.16@.16½	38.00 per M	.16
Sal soda, per lb.	.02	.02	.02
Roll sulphur, per lb.	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.108	.11	.11
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.65	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.30	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade	50%	50–10%	50%
Second grade	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales or less.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0324
Cold drawn shafting	per lb.	.034	.034	.033
Brass rods	per lb.	.1875	.1825	.165
Solder (½ and ½)	per lb.	.3475	.3575	.3675
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.	per 100.	3.59	3.59	3.10
Lard cutting oil	per gal.	.65	.65	.65
Machine oil	per gal.	.30	.30	.27
Belting, leather, medium	off list.	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs	off list.	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper	$4.05	$4.29	$4.29
Emery cloth	20.22	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper	2.04	2.04	2.04
Cloth	3.59	3.59	3.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.75@2.85
Coke, prompt foundry, per net ton	Connellsville,		3.75@4.50
White lead, dry or in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York	14.75

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts, square heads and nuts:	Full Kegs or Cases
Up to ¾ x 6-in.	55%
Larger, up to 1 x 30-in.	50%
1¼ and 1½ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square or hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb.	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia.	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Mich., Detroit—Cadillac Motor Car Co., 2860 Clark Ave.—general equipment for proposed 4 story, 220 x 395 ft. machine shop.

Mich., Detroit—Cadillac Tool Products Co., 2016 Franklin St.—shaper, also grinder and equipment.

Mich., Detroit — Cowan Sheet Metal Works Inc., 411 West Woodbridge St.—sheet metal shop equipment including shear.

Mich., Detroit—Dept. of Purchases & Supplies, 735 Randolph St., J. E. Mills, Comr.—will receive bids until Jan. 26 for combined punch and shear and car wheel borer.

Mich., Detroit—Liberty Starter Co., Minnie and West Fort Sts.—miscellaneous machine equipment for proposed 4 story, 27 x 120 ft. automobile parts factory. Estimated cost $50,000.

Mich., Detroit—Superior Machine & Engineering Co., 1930 Ferry Park Ave.—grinder and equipment.

Mo., Poplar Bluff—Missouri Pacific R.R. Co., Missouri Pacific Bldg., St. Louis—W. A. Hopkins, Gen. Purch. Agt.—tools and equipment for proposed 5 stall extension to round house here. Estimated cost $100,000.

Mo., St. Louis — Hoew Scale Co., 3001 North Broadway—shaper with 14 in. stroke.

Mo., St. Louis—Bd. of Public Service—will receive bids until Feb. 13, for a 10 ton box girder electric crane for Fire Department repair shops in municipal service building.

O., Cleveland — Lamson & Session Co., 1971 West 85th St., G. W. Hinds, Purch. Agt.—machinery and equipment for proposed 4 story, 83 x 182 ft. addition to factory. Estimated cost $200,000.

O., Youngstown—Republic Iron & Steel Co., South Market St.—two gang slitting shears with automatic reels.

Pa., Colfax — Byllesby Engineering & Management Corp., 435 6th Ave. Pittsburgh—5 ton crane 49 ft. span for machine shop here.

Pa., Franklin — Miles P. Brown Boiler Works—5 to 7½ ton overhead crane, 58 ft. span.

Pa., Latrobe—Latrobe Electric Steel Co.—5 ton crane and 8 ton steam hammer.

Texas—Missouri-Kansas-Texas R.R., St. Louis, Mo., G. E. Scott, Purch. Agt.—shop machinery and tools to cost $156,132.

Tex., Jacksonville—Humble Oil & Refining Co., Humble Bldg., Houston-machinery and equipment for general repairing of oil field machinery, etc. for proposed shop here. Estimated cost $160,000.

Ont., Hamilton—International Airways, Ltd., 56 Charlton Ave. W., R. O. Denman, Mgr.—machinery and equipment for proposed hangar and shops. Estimated cost $60,000.

N. Z., Wellington—New Zealand Government Railways, will receive bids until Feb. 18, for one pattern makers lathe, two screwing machines, one piston ring grinder, six rectangular chucks, 26 x 12 in., four rectangular chucks, 18 x 6 in. four demagnetizers, four twist grinding machines, one welding plant, etc.

Opportunities for Future Business

Calif., Los Angeles — Sampson Tire & Rubber Co., c/o Morgan, Walls & Clements, Van Nuys Bldg., Archts., is having plans prepared for a 265 x 1,350 ft. plant including machine shop, etc.

Calif., Pittsburg—Columbia Steel Co., plans the construction of a steel mill. Estimated cost $2,500,000 including equipment.

Calif., South San Francisco—Pacific Coast Steel Co., Hunter-Dulin Bldg., plans shop additions including 3 story, 100 x 450 ft. bolt and nut plant, 150 x 880 ft. machine shop, etc. Estimated cost $600,000. Noted Sept. 27.

Calif., Torrence — Hercules Portland Cement Co., c/o H. H. Helbush & Co., Agts., 2300 Wilshire Blvd., Los Angeles, is having plans prepared for the construction of a plant including machine shop, etc. here. Estimated cost $3,500,000. Private plans.

Conn., Bridgeport—Bridgeport Hardware Co., 461 Iranistan Ave., is having plans prepared for a 1 story, 100 x 100 ft. addition to factory. Estimated cost $42,000.

Conn., Greenwich — Allen Bros. Garage Inc., 140 Greenwich Ave., is having plans prepared for a 3 story garage. Estimated cost to exceed $50,000. Private plans.

Del., Wilmington — Bellanca Aircraft Corp., awarded contract for an 85 x 150 ft. factory. Estimated cost $66,000.

Ind., Evansville — National Furniture Mfg. Co., 301 West Keller St., awarded contract for a 100 x 160 ft. factory. Estimated cost $50,000. Private plans.

Ind., South Bend—South Bend Forge Co., Westmore St., awarded contract for a 1 story, 60 x 200 ft. factory. Estimated cost $50,000.

Mass., Cambridge (Boston P.O.)—Blanchard Machine Co., 64 State St., awarded contract for a 1 story, 90 x 100 ft. machine shop. Noted Nov. 8.

Mich., Detroit—Burroughs Adding Machine Co., 6071 Second Ave., is having plans prepared for a 1 story, 60 x 180 ft. addition to adding machine factory on Second Ave. Estimated cost $50,000. A. Kahn, 1000 Marquette Bldg., Archt.

Mich., Detroit—Cadillac Motor Car Co., 2860 Clark Ave., is having plans prepared for a 4 story, 55 x 275 ft. engineering building. Estimated cost $300,000. Private plans.

Mich., Detroit — Federal Motor Truck Co., 5780 Federal Ave., awarded contract for a 2 story, 60 x 400 ft. addition to truck factory. Estimated cost $150,000.

Mich., Detroit—Fisher Body Corp., General Motors Bldg., awarded contract for a 1 and 6 story, 235 x 340 ft. automobile body plant on Beaubien St.

Mich., Flint—Marvel Carburetor Co., 1910 St. John St., awarded contract for a 1 story, 140 x 175 ft., engine parts factory. Estimated cost $50,000.

Mich., Jackson—American Gear & Mfg. Co., Park Ave., awarded contract for a 1 story, 60 x 300 ft. heat treating plant on Park Ave. Estimated cost $140,000.

Mich., Wayne—Stinson Aircraft Corp., Northville, awarded contract for a 1 story, 180 x 300 ft. airplane factory. Estimated cost $175,000.

Minn., Minneapolis—Brooks Parlor Furniture Co., A. Brooks, Pres., 1115 East Hennapin Ave., plans the construction of a 3 story addition to factory. Estimated cost $175,000. Architect not announced.

Minn., Minneapolis—Imperial Machinery Co., 1611 Central Ave., awarded contract for a 1 story, 180 x 200 ft. factory at 1529-1609 Central Ave. Estimated cost $60,000.

Neb., Omaha—Missouri Casket Co., 1350 Woodwether Ave., Kansas City, Mo., awarded contract for a 3 story, 66 x 114 ft., casket factory. Estimated cost $100,000.

N. H., Dover—Kidder Press Co., Broadway, will soon award contract for a 1 story, 55 x 200 ft. addition to machine shop on Broadway. J. E. Richardson, 56 Grove St., Archt.

N. Y., Brooklyn—Superior Ash Can Co., M. Passman, Pres., 113 Chester St., plans the construction of an 85 x 88 ft. machine shop at East 101 St. and Foster Ave. Estimated cost $40,000. I. Kallich, 26

N. Y., Laurel Hill (mail Flushing)—Nichols Copper Co., awarded contract for the construction of a copper sulphate refinery at Hobson and Halle Aves. Noted Nov. 22.

N. Y., Richmond Hill (br. Jamaica)—Suburban Bronze & Iron Co., Atlantic Ave. and 101st St., Queens Village, is receiving bids for the construction of a factory at Atlantic Ave. and 129th St. here. Estimated cost $90,000. Koch & Wagner, 32 Court St., Brooklyn, Archts. Noted Dec. 27.

O., Barberton — Ric-Wil Co., manufacturers of door hangers, awarded contract for a 1 story, 80 x 83 ft. factory. Estimated cost $40,000.

O., Canton—Eller Mfg. Co., 1210 Camden Ave. N. W., plans the construction of a 1 story, 40 x 250 and 112 x 320 ft. factory for the manufacture of sheet metal products. Estimated cost $40,000.

O., Cincinnati—Crosley Radio Corp., Colerain Ave., plans the construction of an 8 story factory. Estimated cost $500,000. S. Hannaford & Sons, 1024 Dixie Terminal, Archts.

O., Cleveland—Bd. of Education, F. G. Hogen, Dir., will receive bids until Jan. 28 for a 1 story foundry on Eagle Ave. Estimated cost $44,000. G. M. Hoppinson, Auditorium Garage Bldg., Archt. Noted Dec. 20.

Pa., Latrobe—Latrobe Electric Steel Co., plans the construction of a 1 story addition to mill. Estimated cost $50,000. Private plans.

Pa., McKeesport — National Tube Co., F. W. Waterman, Pres. Pittsburgh subsidiary of U. S. Steel Co., 71 Broadway, New York, is having plans prepared for the construction of a tube mill to replace old butt and lapweld mill here. Estimated cost $20,000,000. Private plans.

Pa., New Castle—Johnson Bronze Co., awarded contract for the construction of two 2 story, 85 x 152 and 120 x 158 ft. factory buildings. Estimated cost $100,000.

Pa., Philadelphia — American Container Co. awarded contract for a 3 story, 60 x 100 ft. addition to plant at Shunk and Swanson Sts. Estimated cost $100,000.

Pa., Philadelphia—I. Fischman & Sons, 10th and Allegheny Sts., soda water manufacturers, plans a 1 and 2 story factory at Erie Ave. and F St. C. E. Wunder, 1520 Locust St., Archt.

Pa., Philadelphia—Union Dental Instrument Mfg. Co., 831 Cherry St., plans the construction of a 4 story, 57 x 150 ft. factory at 702 North Franklin St. Estimated cost $225,000. D. Supowitz, 929 Chestnut St., Archt.

Tex., Beaumont—Kansas City Southern Ry., Kansas City, Mo., is receiving bids for complete yard and switching system to include mechanical shop, warehouse, etc., here. Estimtaed cost $1,00,000. A. N. Reece, Ch. Engr.

Tex., El Paso—Nichols Copper Co., c/o C. W. Nichols, Pres., 25 Broadway, New York, plans the construction of a copper refinery to include 60 x 200 ft. machine shop, 40 x 200 ft. warehouse, etc., here. Estimated cost $3,50,000.

Tex., El Paso—United Mines Co., Parral Dist., Mexico, is having preliminary surveys made for the construction of a zinc refinery here. Estimated cost $4,500,000.

Wash., Aberdeen—Consolidated Furniture Manufacturers, Seattle, plans the construction of a plywood mill and saw mill here.

Wis., Milwaukee — Cutler Hammer Co., 12th and St. Paul Sts., plans the construction of a plant. Estimated cost $2,000,000. Architect not selected.

Ont., Ford City—Servel Inc., Hercules Products Div., awarded contract for the construction of a 1 story, 60 x 150 ft. automobile body plant. Estimated cost $75,000.

Ont., Peterborough—Western Clock Co., Hunter St. N., plans the construction of a 3 or 4 story addition to plant at Hunter St. N. Estimated cost $200,000. Architect not selected.

Que., Montreal—Robert Mitchell Co. Ltd., 109 Lafayette St., New York, N. Y., plans the construction of a foundry here.